

Type RVE and WVE, Three-Phase Maintenance Instructions

S280-40-5 Service Information

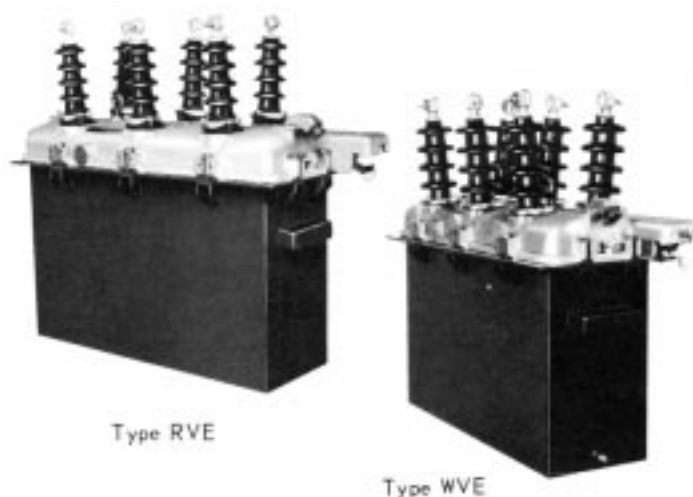
24.9 kv • 400 Amp (Type RVE) 560 Amp (Type WVE)

This manual, bulletin S280-40-5, for Type RVE and WVE electronically controlled reclosers covers:

- maintenance of the interrupting mechanism
- operational checks for circuit components attached to the head casting and mechanism frame
- testing of the control cable and bushing current transformers
- replacement of mechanical and electrical components
- replacement parts for the interrupting unit

A separate manual, bulletin 280-75-2, is a service manual which covers the electronic control and provides information on general inspection, operational checks, and battery testing and charging. Procedures for testing the recloser and control together are found in the control installation manual, bulletin S280-75-1.

CAUTION: DO NOT ENERGIZE THIS EQUIPMENT OUT OF OIL



ORDER OF CONTENTS

Page	Page
Introduction.....1	Rating Changes14
Description of Type Recloser2	Adjustments.....14
General Maintenance Information2	Operational Checks.....14
Maintenance Intervals.....2	Control Cable15
Desirable Oil Specifications4	Circuit Components.....15
Periodic Field Inspection and Maintenance.....4	Bushing Current Transformers17
Shop Maintenance6	Replacement Instructions for
Arc Interrupting Assembly	Circuit Components.....18
Type RVE Reclosers6	
Arc Interrupting Assembly	
Type WVE Reclosers8	Service Parts List
Closing Solenoid9	Basic Parts List
Closing Solenoid Contactor10	Types RVE and WVE Reclosers
Closing Solenoid Fuses10	Tank and Cover Assemblies.....21
Bushings	Closing Solenoid Parts.....24
Type RVE Recloser11	Parts List for Interrupting Mechanism
Type WVE Recloser11	Type RVE Recloser26
Removal of Head Casting12	Parts List for Interrupting Mechanism,
	Type WVE Recloser27
	Head Mechanism Parts List
	Type RVE and WVE Reclosers28
Mechanism Operation13	

These instructions do not claim to cover all details or variations in the equipment, procedure, or process described, nor to provide direction for meeting every possible contingency during installation, operation, or maintenance. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact your Cooper Power Systems sales engineer.

DESCRIPTION OF RECLOSER

The Types RVE and WVE reclosers are self-controlled devices that protect distribution lines and equipment. Each unit consists of a circuit interrupting device, hereafter referred to as the recloser, an electronic control, and a connecting cable. Fault current sensing is achieved by the control which actuates the recloser. Circuit interruption is provided by the recloser.

A Type RVE or WVE recloser performs similarly to other reclosers in that it trips and automatically recloses. If a fault is temporary, reclosing of the contacts restores normal service. If the fault is permanent, the recloser senses this by performing a preset number of operations and locking open. All three phases of a Type RVE or WVE recloser open and lock out simultaneously.

Opening sequences of the recloser can be all fast, all delayed, or any combination of fast followed by delayed operations up to a total of four. Fast operations clear temporary faults before branch-line fuses can be damaged. Delayed openings allow time for fuses to clear so permanent faults can be confined to smaller sections of line.

Arcs are extinguished in the rugged arc-interrupter assemblies, figure 1, which utilize the proven selfblast principle of arc interruption. Moving contacts are driven by powerful opening springs that are charged when the recloser is closed.

Closing is accomplished when a line-voltage solenoid is connected across two phases of the distribution line. This connection occurs when a rotary solenoid, located inside the recloser, allows the closing solenoid contactor to close.

A trip-free control lever, linked with the interruption mechanism, is provided to lock the recloser open manually. This lever, located under the sleet hood, cannot be used to close the recloser, but it must be in the CLOSED position before the electronic control can cause the recloser to close. A contact position indicator, linked to the interrupting mechanism but independent of the control lever, is provided under the sleet hood.

GENERAL MAINTENANCE INFORMATION

Maintenance Ensures Reliable Performance

Reclosers are widely applied to increase service continuity, reduce system operating costs, and increase

revenue. The Type RVE or WVE performs all these recloser functions by combining the flexibility and reliability of electronic control with proven interrupting mechanisms to achieve superior distribution circuit protection. However, the recloser can perform at peak efficiency only if it is maintained in good condition. While maintenance is relatively easy and inexpensive, it is important.

Oil plays an essential role in arc interruption, insulation, and reclosing. Arc interruption, however, contributes to oil decomposition. For this reason, the oil steadily diminishes in dielectric strength as the recloser continues to clear fault currents. Breathing action may also result in moisture absorption by the oil, thus lowering its insulation value. For effective recloser operation, oil must be replaced before it deteriorates beyond a safe level.

Climate and Duty Determine Maintenance Intervals

Frequency of maintenance depends upon local climatic conditions and the interrupting duty imposed on the recloser. M-E recommends the unit be inspected completely, cleaned, and filled with new oil at least once each year. If the recloser operates through a duty cycle in less than one year, periodic maintenance should be performed then.

The duty cycles are as follows:

Type RVE Recloser

Fault Current Percent of Interrupting Rating	Recloser Operations	Maximum Circuit X/R Value
15-20	28	4
45-55	24	8
90-100	10	15
Total 62		

Type WVE Recloser

Fault Current Percent of Interrupting Rating	Recloser Operations	Maximum Circuit X/R Value
15-20	28	4
45-55	20	8
90-100	10	15
Total 58		

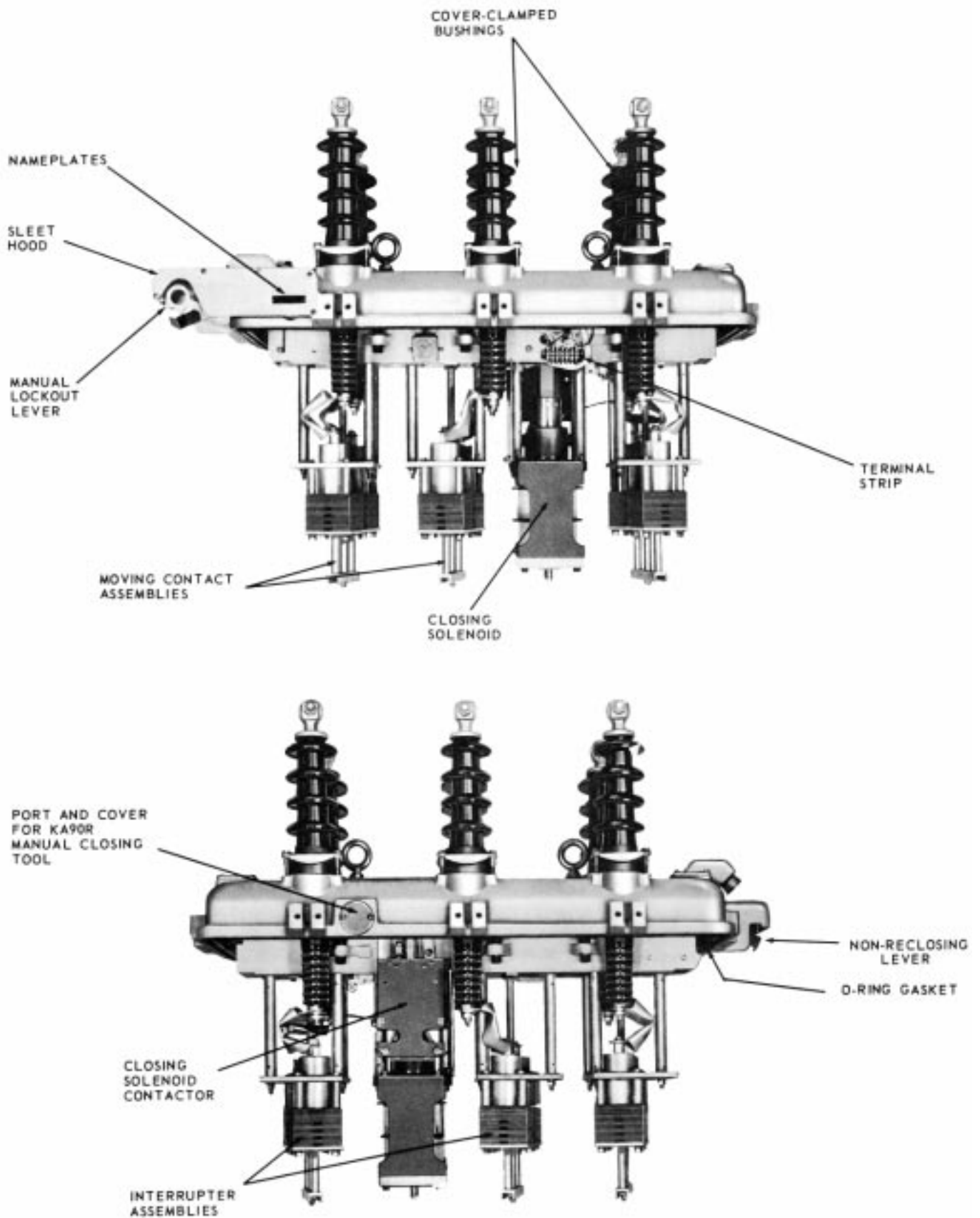


Figure 1
Principal Components - Types RVE and WVE Reclosers
(Type RVE Shown here)

GENERAL MAINTENANCE INFORMATION - CONT'D.

High Dielectric Strength Maintains Oil Effectiveness

Although the Type WE can undergo a complete duty cycle without requiring an oil change, more frequent oil changes will be required if the majority of fault currents are near the maximum interrupting rating. Oil that has become contaminated with carbon and sludge, or has a dielectric strength of 18 kv or lower, should be replaced. Use only oil that meets the requirements tabulated below for L-M switchgear. Refer to "ASTM Methods of Testing Electrical Insulating oil," Publication D117. This publication is available from the American Society for Testing Materials, 1916 Race Street, Philadelphia, Pennsylvania.

CHARACTERISTICS OF OIL FOR M - E SWITCHGEAR

Color: nearly colorless

ASTM colorimeter1.0 max.

Union colorimeter2.0 max.

Reactionneutral

Neutralization number0.03 mg KOH/g max.

Free sulphurnone

Corrosive sulphur3 max.

Steam emulsion number.....25 seconds max.

Flash point.....145°C min.
(293° F)

Fire point160°C min.
(320° F)

Pour point.....(-45.6°C max.)
(-50° F)

Viscosity:

at 37.8°C (100°F)

Saybolt Universal62 sec. max.

at 0°C (32°F)

Saybolt Universal320 sec. max.

Specific gravity:

at 20.0°C (68.0°F)0.895/cc max.

Co-efficient of expansion:

at 0°C (32°F).....0.000725

at 100° C (212° F)0.000755

Interfacial tension.....40 dynes/cm min.

Dielectric constant.....2.2

Dielectric strength26,000 volts min.

Weight per gallon.....7.5 lbs.

Water content40 parts/million max.
(Fischer test)

Servicing Locations Vary with Amount of Maintenance

Routine inspection, minor maintenance, most adjustments, and replacement of oil can be performed on a recloser without removing it from the mounting frame. Repairs or major maintenance work should be performed in the shop.

PERIODIC FIELD INSPECTION AND MAINTENANCE

Each periodic check should include at least the following steps:

1. BYPASS, TRIP, AND DE-ENERGIZE THE RECLOSER

Disconnect the control cable from the recloser.

2. INSPECT EXTERNAL COMPONENTS

Check for broken bushings, paint scratches, or other mechanical damage.

3. LOWER THE TANK TO EXPOSE INTERNAL COMPONENTS

Attach sheaves of the tank-hoisting mechanism to recloser tank, and take up slack. Then remove the ten bolts to release the tank from the head casting.

CAUTION: Be sure the recloser is tripped before lowering the tank, so the recloser will not be tripped accidentally while the mechanism is out of oil.

4. INSPECT MOVING CONTACTS

Arcing tips of the moving contacts can experience considerable erosion before replacement is necessary. The contacts should be replaced before their effectiveness is impaired by erosion of the load current contact surfaces.

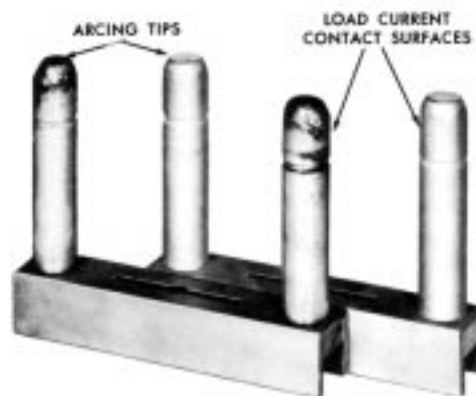


Figure 2

Left: moving contact assembly after one full duty cycle; right; contact assembly new.

Figure 2 shows a set of moving contacts after they have experienced severe interrupting duty, and a new set for comparison. The used contacts shown have reached the condition where they should be replaced.

If moving contacts appear to have further useful life, inspection of the arc interrupter chamber and stationary contacts can be omitted. These components are designed to last at least the life of the moving contacts.

5. INSPECT STATIONARY CONTACTS

If moving contacts of any phase or phases are in questionable condition, the corresponding stationary contacts should be inspected. Refer to page 7 or 9 for instructions on removal and reassembly of the fiber plates that form the arc interruption chambers. Removal of these plates is necessary for inspection of the stationary contacts.

Figure 3 shows a stationary contact assembly after one duty cycle and a new assembly for comparison. Note that erosion of the load current contact surfaces has started. The six contact segments or the entire assembly should be replaced.

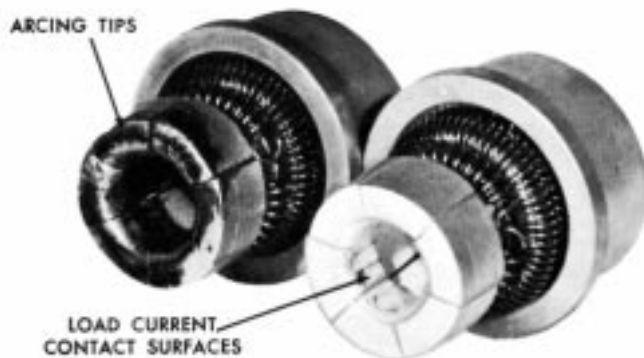


Figure 3

Left: Stationary contact assembly after one full duty cycle;
right: new contact assembly.

6. INSPECT ARC INTERRUPTER CHAMBERS

The insignificant cost of the fiber plates making up the arc interrupter chambers permits complete replacement whenever the stationary contacts are replaced. A visual comparison of bottom and top plates will indicate necessity for replacement. The top plates closest to the stationary contacts and nearest to the most arcing will show enough erosion to provide a decision for replacement.

7. CLEAN ALL INTERNAL COMPONENTS

Remove all carbon traces by wiping with a clean, lint-free cloth. Pay particular attention to all insulating members. Flush the mechanism with clean, dry transformer oil.

CAUTION: Never use volatile solutions, detergents, or water-soluble cleaners.

8. DRAIN OLD OIL

Remove the 1/2-inch pipe plug at the bottom of the tank, or open the tank valve if one has been installed. Rinse the tank with clean oil, and wipe out all carbon traces with a clean lint-free cloth.

9. INSPECT TANK LINERS

Any soft or spongy areas in the liners indicate moisture has been absorbed. These areas are most likely to occur near the bottom of the tank. When replacing liners, be sure the new liner installed in each section is the same size as the original.

If interrupting duty is severe, the tank liners may be eroded near the exhaust ports of the arc interrupting structures. Replace any liners that show appreciable erosion.

Replacement liners come in a kit; as part number KA867R. See Parts List, Page 23, item 86.

10. CHECK CIRCUIT COMPONENTS ATTACHED TO THE RECLOSER COVER, FRAME, AND OPERATING MECHANISM

These components are identified in figures 17, 24 and 27. Be sure all wiring to the terminal strip is secure at each terminal. The rotary solenoid and trip solenoid should be firmly attached to the recloser frame.

Check mercury switches attached to the counter shaft and main shaft. They should be securely held in place by the nylon mounting straps. Check the microswitch mounted above the main shaft. It should be firmly held in place by the mounting bracket. Check bushing current transformers. See that wiring is in order.

11. FILL TANK WITH OIL

Use only new transformer oil with dielectric strength of at least 26 kv, as measured across a standard 0.1-inch gap in accordance with methods presented in ASTM Publication D117. The oil level should be 2-1/4 inches from the top of the tank with the mechanism removed. The level can be double checked with the oil level gauge after the mechanisms and head casting have been fastened in place. The capacity of the tank is approximately 38 gallons.

GENERAL MAINTENANCE INFORMATION - CONT'D.

12. REPLACE TANK

Clean the -ring head gasket and the tank gasket seat. Move the control lever to the closed position to avoid any possible binding while raising the tank. Raise the tank and secure it to the head casting with the ten head bolts.

13. CHECK LOCKOUT LEVER AND CONTACT POSITION INDICATOR

Correct operation of these components can be observed by manually operating the recloser.

14. MANUAL OPERATION

Remove the closing tool port cover and gasket and insert a KA90R closing tool. Manual operation can now be achieved by closing with the KA90R tool and tripping the recloser with the lockout lever. See figure 4.

CAUTION: Never use the KA90R tool on an energized recloser.

If a recloser is to be tripped out of oil, use the closing tool to open the contacts. While one person turns the tool clockwise against the stop, another can move the trip lever, shown in figure 5, to the right. Now let the tool slowly rotate counterclockwise to open the contacts. Replace port cover and gasket when manual operation is completed.

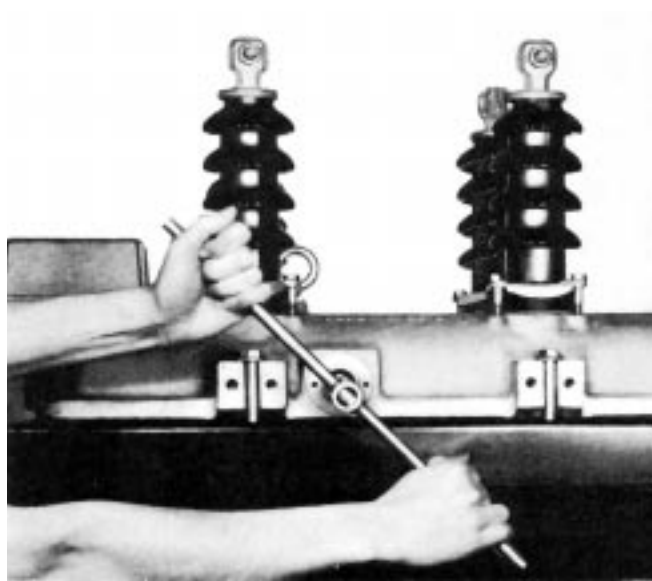


Figure 4

Rotating the KA90R tool clockwise to manually close the recloser.

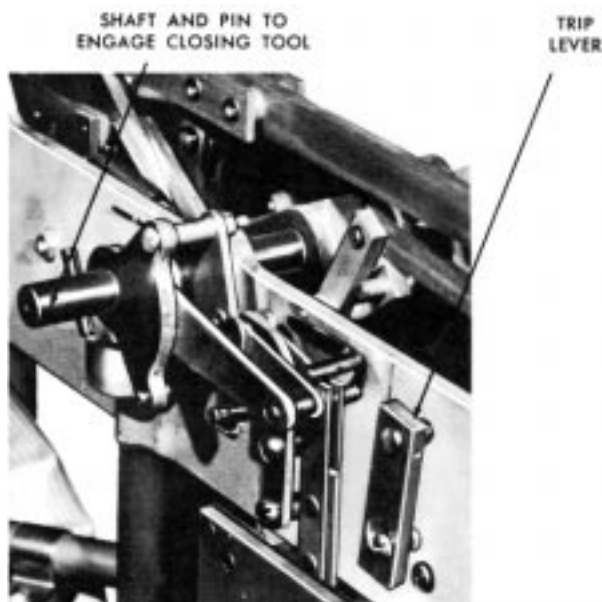


Figure 5

Move trip lever to the right to release recloser when opening with closing tool.

15. CONNECT CONTROL CABLE TO RECEPTACLE ON RECLOSER HEAD CASTING

Place recloser in service according to procedures outlined in the recloser installation manual, bulletin S280-40-2.

NOTE: Electronic control can be checked out with or without recloser in service. Periodic operational checks can be made according to the control service manual.

SHOP MAINTENANCE

When shop maintenance or repairs are to be performed, remove the ten bolts that secure the head casting to the tank. With suitable hoist, raise the recloser mechanism out of the oil and allow it to drain. The recloser can be left suspended by the hoist, inverted and placed on a workbench, or the mechanism frame ends can be supported by a special rack.

ARC-INTERRUPTER ASSEMBLY, TYPE RVE RECLOSER (See Page 8 for WVE Instructions)

After the RVE recloser has operated through a complete duty cycle, the arc interrupter assembly should be completely dismantled and any worn parts replaced. Refer to Figure 6.

1. Remove the vibration-proof nut that secures the moving contact yoke to the contact-lift rod. Two square spacer washers will be released.

SHOP MAINTENANCE (CONT'D.)

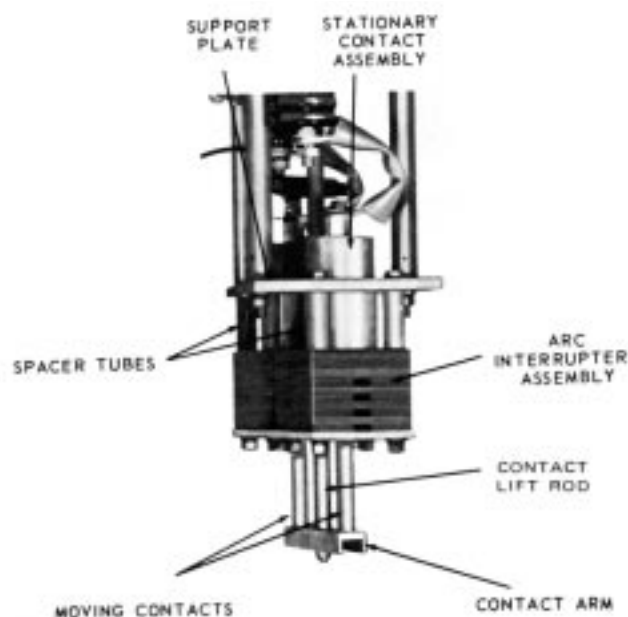


Figure 6
Arc interrupting assembly.

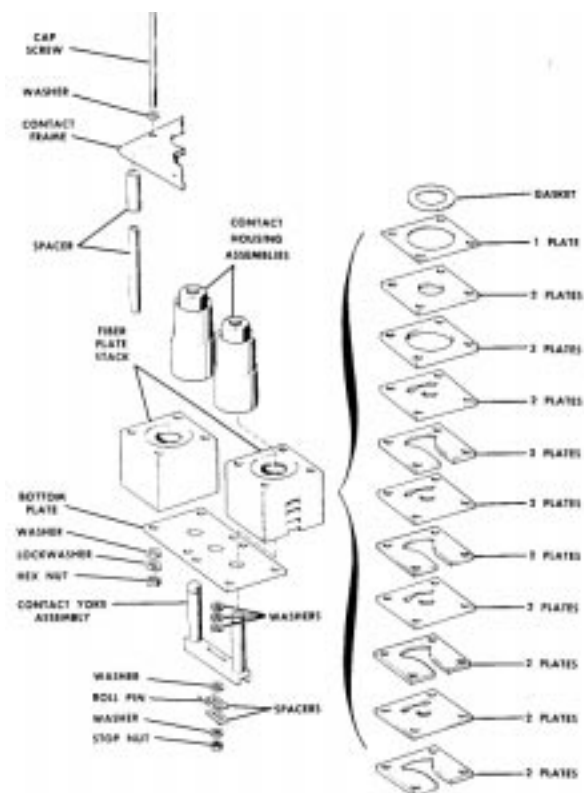


Figure 7
Components of Arc Interrupter Assembly
Type RVE Recloser

2. Drive out the roll pin located near the end of the contact-lift rod. Be sure to back the rod with a heavy, solid object when driving out the roll pin.
3. Slide the contact yoke from the lift rod. Save all the spacer washers.
4. Remove the terminal bolt from the top of each stationary contact assembly.
5. Remove hex nuts, flat washers, and lock washers from bottom of interrupter assembly.
6. Slide the arc interrupter assembly downward. Figure 7 shows the individual parts in the order of removal.
7. Examine the stationary contact segments to determine if arc erosion has spread to the load contact surfaces. If so, the contact segments only, or the entire stationary contact assembly, should be replaced.
8. Insert a large screwdriver through the stationary contacts to engage the fillister screw slot. With a box wrench, loosen and remove the contact nut while the screwdriver is held securely in a vise. Remove contact arms, contact cup, and retaining washer, leaving the retaining ring, which rests in a slot on the inside of the tube. Figure 8 shows a dismantled stationary contact assembly.

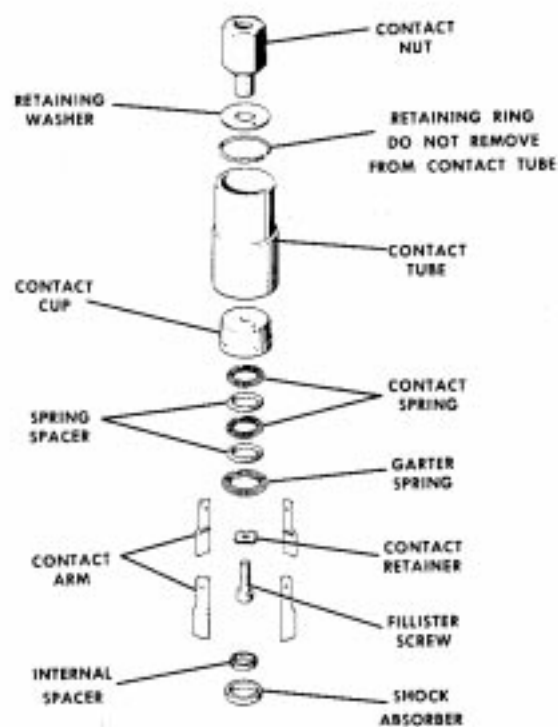


Figure 8
Stationary Contact Assembly Components
Type RVE Recloser

- ARC-INTERRUPTER ASSEMBLY,
TYPE WVE RECLOSER
(see Page 6 for RVE Instructions)**

After the WVErecloser has operated through a complete duty cycle, the arc interrupter assembly should be completely dismantled and any worn parts replaced. Refer to figure 6.

1. Using a 1/2-inch thin wall socket, remove the vibration-proof hex nut that secures the contact yoke to the lift rod. Gently tap contact arm to remove contacts from the lift rod.
2. Remove the terminal bolt from the top of each stationary contact assembly.
3. Remove hex nuts, flat washers, and lock washers from bottom of interrupter assembly.
4. Slide the arc interrupter assembly downward. Figure 9 shows the individual parts in the order of removal.
5. Examine the stationary contact segments to determine if arc erosion has spread to the load contact surfaces. If so, the contact segments only, or the entire stationary contact assembly, should be replaced.

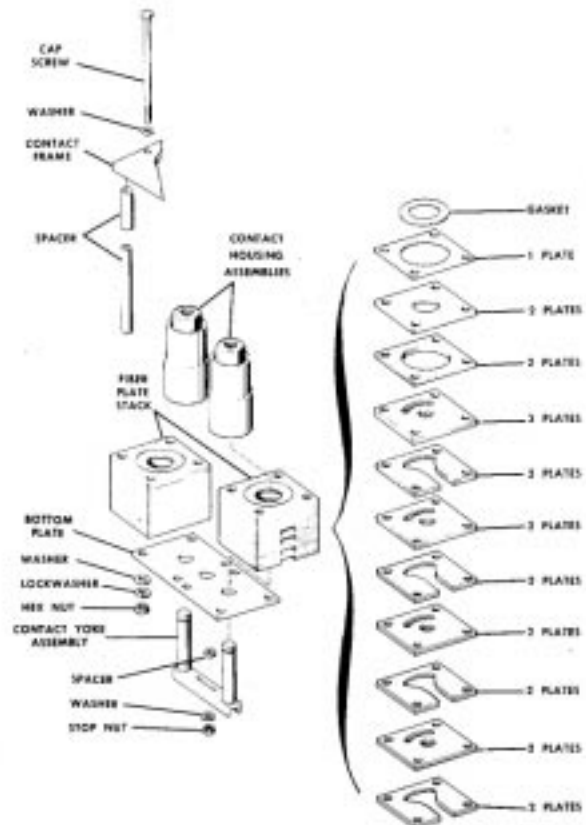


Figure 9
Components of arc interrupter assembly.
Type WVE Recloser

6. Insert a large screwdriver through the stationary contacts to engage the fillister screw slot. With a box wrench, loosen and remove the contact nut while the screwdriver is held securely in a vise. Remove contact arms, contact cup, and retaining washer, leaving the retaining ring which rests in a slot on the inside of the tube. Figure 10 shows a dismantled stationary contact assembly.
7. To reassemble the stationary contacts slip the contact retainer onto the fillister head cap screw and arrange the six contact segments around the screw and retainer. Each of the six teeth on the retainer should fit into a hole on a contact segment. Place the garter spring, contact springs, and spring spacers over the small end of the assembly in the following order: garter spring, spring spacer, contact spring, spring spacer, and contact spring. Insert this assembly into the contact cup by twisting in clockwise. Then push the cup and contacts into the large end of the tube. Insert the retaining washer and contact nut from the opposite end. Use the large screwdriver to hold the fillister head cap screw while the contact nut is tightened.
8. Replace the fiber plates in the arc interruption assembly if necessary. Refer to periodic maintenance, page 5 for the method of determining when these plates should be replaced.

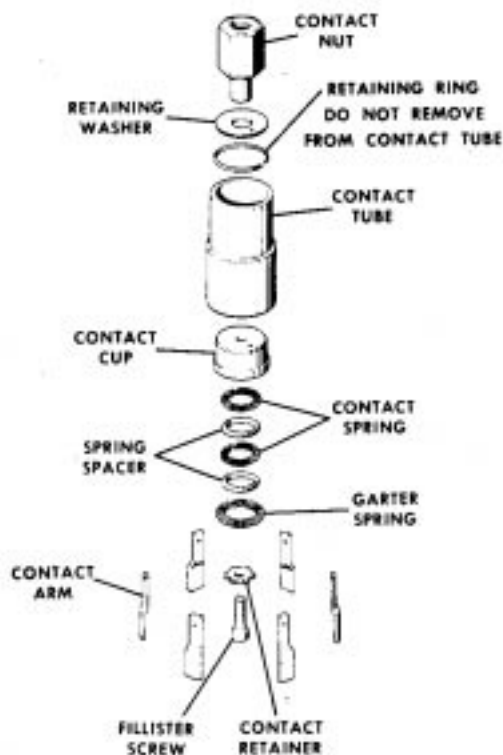


Figure 10
Stationary contact assembly components
Type WVE Recloser

9. Examine the insulating support stringers for evidence of tracking or moisture absorption. Failure of these members is rare, but if any show tracking, replace as follows:
 - a. Remove the hex nuts, lock washers, and flat washers that secure the phenolic contact support plate to the stringers.
 - b. Loosen the stringers with pliers and remove
 - c. Install new members as required and reassemble.
10. Refer to figure 9 and reassemble the interrupter in the following order:
 - a. Place the fiber plates in two stacks on top of the bottom plate, in the order shown in figure 9. Make sure that the gasket is included. The exhaust ports open to the outside of the assembly.
 - b. Drop the long spacer tubes into the corner holes of the two stacks. The lower end of each spacer tube should be flush with the lower surface of the bottom plate. Place the short spacer tubes over the portions of the long spacer tubes which protrude from the stacks.
 - c. Position the stationary contact assemblies on top of the two stacks.
 - d. Place the assembly in position on the contact frame and secure it with the eight mounting bolts. Reconnect the leads to the contact nuts.
 - e. Install the moving contacts on the lift rod.

CLOSING SOLENOID

Little maintenance is required for the closing solenoid. However, if the recloser is to be operated at another voltage, replace the solenoid coil as follows:

1. Disconnect the two coil leads from the closing solenoid contactor, figure 11.
2. Remove four capscrews on the bottom of the solenoid frame and lower the coil and base plate. Lift the coil from the base plate.

SHOP MAINTENANCE (CONT'D.)

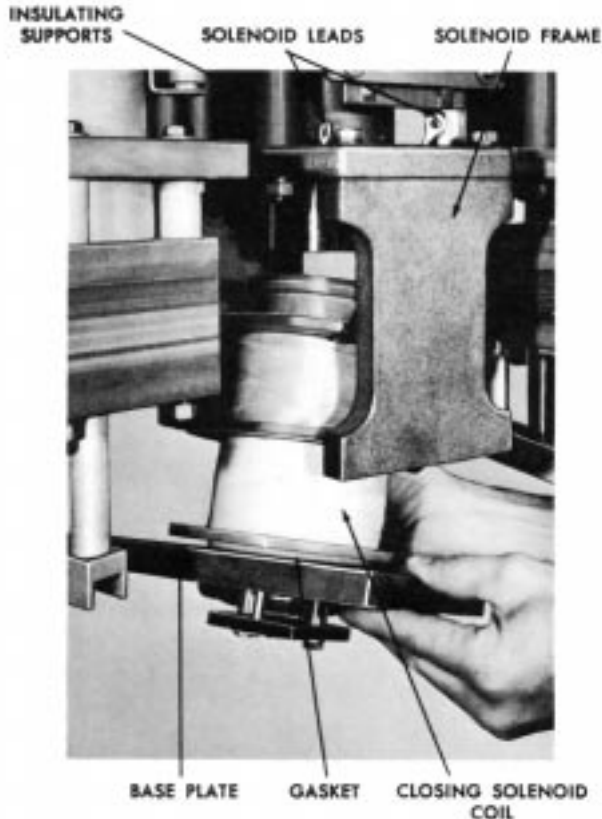


Figure 11
Removing closing solenoid coil.

3. Examine the insulating supports for evidence of tracking or moisture absorption. Replace any defective members as follows:

Remove the hexnuts, lock washers, and flat washers that secure the solenoid frame to the supports. Then lower the solenoid frame slowly to avoid damaging the closing plunger. Loosen defective supports with pliers and remove. Install new members as required and reassemble.

4. Install the closing solenoid. Be sure to use a new gasket between the coil and solenoid base plate. Also see that solenoid leads clear insulating supports and the solenoid frame by at least 1/2-inch.

CLOSING SOLENOID CONTACTOR

If the double-break contacts of the closing-solenoid contactor require replacement, install an entire new closing-solenoid contactor as follows:

1. Disconnect closing solenoid and fuse leads from contactor.

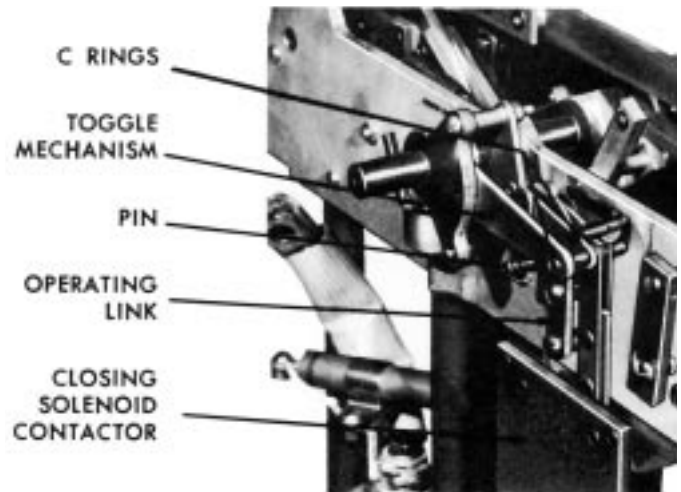


Figure 12
Releasing contact operating rod of closing solenoid contactor from toggle mechanism.

2. Remove three C rings to release pin that connects the operating link to the toggle mechanism, figure 12. Two C rings are between the operating link and toggle mechanism. The third is located on the outer end of the pin.
3. With a long nose pliers, release the springs between the operating link and toggle from the pin. Then push pin through toggle mechanism and operating link.
4. Remove the three hexhead cap screws that secure the contactor to the underside of the recloser frame. Contactor is now free to be removed.
5. Replace the contactor by reversing the above procedure. Use new C rings on toggle-mechanism pin. Be sure closing-solenoid and fuse leads clear insulating supports and grounded parts by at least 1/2-inch.

CAUTION: Fuse and ground leads must be connected to upper terminals of contactor.

CLOSING SOLENOID FUSE

To replace a blown closing solenoid fuse, simply disconnect the long lead at the closing-solenoid contactor, the short lead at the fuse end, and loosen the mounting strap. Slide out the fuse and install a new one.

A tag attached to each closing solenoid coil shows the color band coding and catalog number of the correct fuse to protect the coil. Table I also shows this information. Note that the voltage rating represents the phase-to-grounded neutral voltage. Be sure fuse lead clears any grounded parts and insulating supports by 1/2 inch.

TABLE 1

Closing Solenoid Phase-to-Phase Neutral Voltage, kv	Fuse Catalog Number*	Color Band	TCC Number (See figure13)
7.2 to 8.32 and 11.0	KA259R-2	Yellow	3
12.0 to 14.4	KA259R-3	Red	2

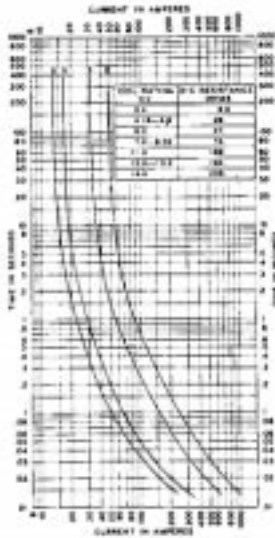


Figure 13

Fuse time-current characteristics for protection of closing solenoid.

BUSHINGS, TYPE RVE RECLOSERS

Maintenance of bushings is generally limited to an occasional cleaning. However, if a bushing should become cracked or broken, replace it as follows:

1. Remove hexnut, lock washer, and flat washers on the lower end of the bushing to release the four flexible straps.
2. Remove the three hexhead cap screws that secure the bushing clamps to the head casting. Lift the bushing assembly up through the head casting.
3. An aluminum clamping ring cushions the pressure between the bushing and bushing clamps. If it is in good condition, the ring can be reused. Twist the ring and slip it from the bushing.
4. The bushing assembly can be completely replaced, or new porcelain only may be installed. If new porcelain is used, unscrew the bushing terminal and pour out the oil from inside the bushing. Loosen the sealing plug and then draw the bushing lead rod out the lower end of the porcelain. Insert the rod all the way into the new porcelain and tighten the sealing plug. Slowly fill the bushing with transformer oil and then replace the bushing terminal, using a new *terminal* gasket.

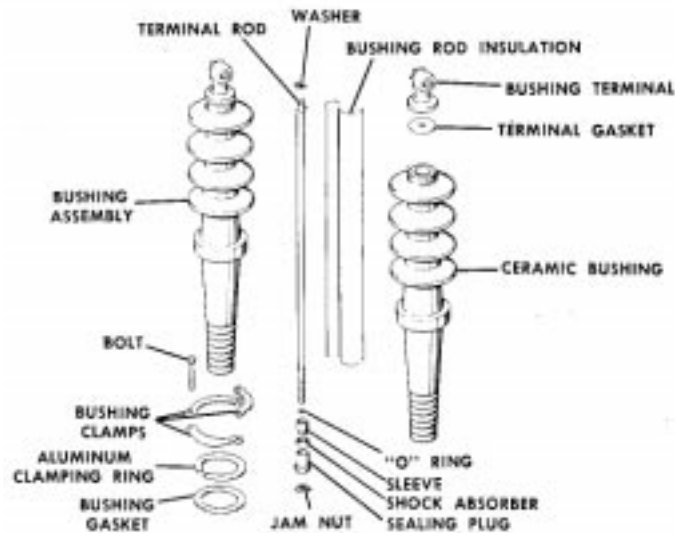


Figure 14
Bushing Replacement
Type RVE Recloser

5. Replace the bushing assembly, using a new gasket between the bushing and the head casting. When securing the bushing clamps, be sure to tighten the three bolts evenly a little at a time.

CAUTION: When reconnecting bushings position flexible leads at least 1/2 inch from any vertical insulating support, grounded part, or contact plunger rod. On reclosers equipped with a ground-trip solenoid, also be sure one center phase lead clears the solenoid frame by 1/2 inch.

BUSHING - TYPE WVE RECLOSERS

Maintenance of bushings is generally limited to an occasional cleaning. If a bushing should become cracked or broken, replace the entire bushing assembly (Type WVE only) as follows:

1. Remove the hex nut, lock washer, and flat washers on the bushing to release flexible straps.
2. Remove the three hex-head cap-screws that secure the bushing assembly to the head casting and lift out the bushing assembly.
3. Replace the bushing assembly using a new gasket between the bushing and the head casting.

CAUTION: When reconnecting bushings, take care to position flexible leads at least 1/2 inch from any vertical insulating support stringer, grounded part, or the contact plunger rod in each phase. on reclosers equipped with a ground-trip solenoid, also be sure one center phase lead clears the solenoid frame by 1/2 inch.

SHOP MAINTENANCE - CONT'D

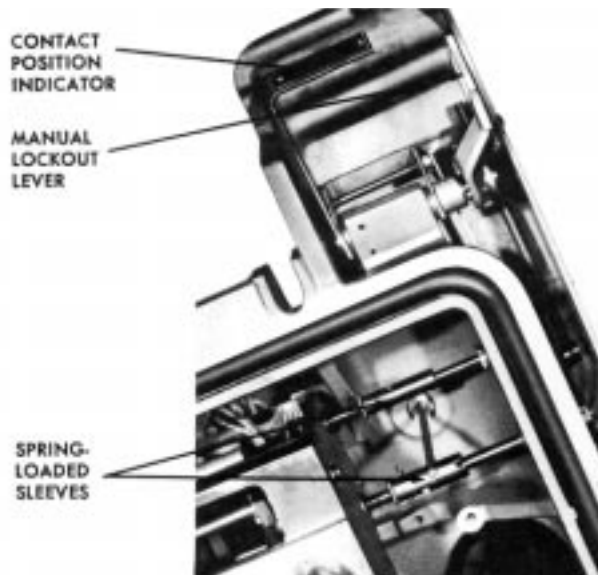


Figure 15

Spring-loaded sleeves of lockout lever and contact position indicator in engaged positions.

REMOVAL OF HEAD CASTING

Access to components located in or on the main frame such as the operating mechanism, mercury switches, trip solenoid, rotary solenoid, and internal wiring, is achieved by removing the head casting. Proceed as follows:

1. Disconnect all bushing leads at the lower end of the bushings.
2. Disengage the lockout lever and the contact position indicator by pushing the spring-loaded couplers inward. Refer to figure 15. Turn the couplers to lock them in the disengaged position.

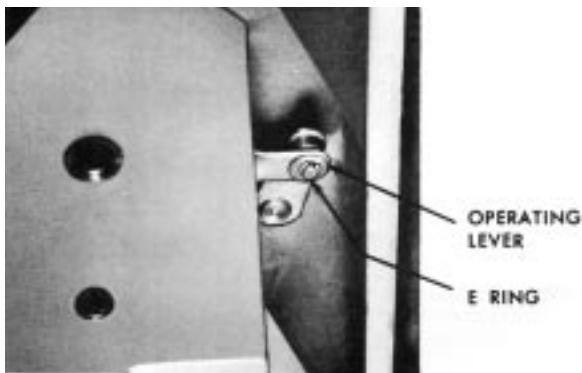


Figure 16

Auxiliary switch disconnection from operating lever before removal of head casting from operating mechanism.

3. If an auxiliary switch accessory is mounted on the recloser head casting, remove the E ring and washer, figure 16, to allow disconnection of the operating lever.
4. Remove the two screws that secure the 0.2-MFD capacitor to the load side of the recloser frame.

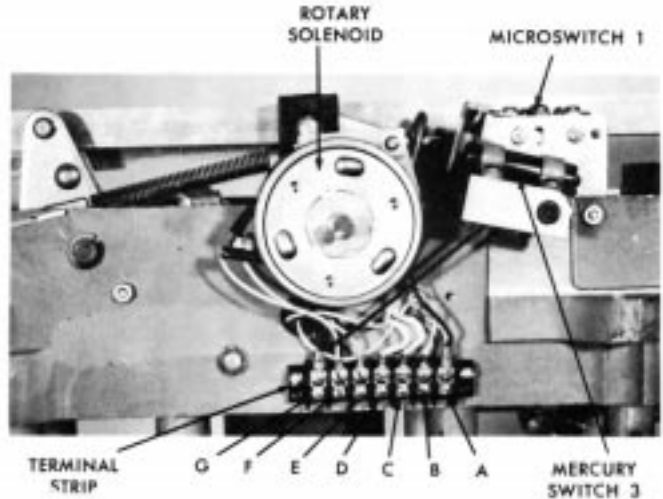


Figure 17

Terminal strip attached to recloser frame.

5. Disconnect the seven leads connected to the lower terminal strip of the terminal block attached to the recloser frame, figure 17. Be sure to label these seven leads corresponding to the terminals from which they are disconnected. Terminals are lettered A through G. *right to left.*

Remove the screw that secures the nylon leadstrap to the frame above the terminal block.

6. Remove the six 1/2" x 4-1/2" hexsocket head bolts that secure the frame to the head casting. Be sure the recloser mechanism is supported from below before these bolts are removed. Six tubular spacers and lock washers will be released when the bolts are removed and the head is lifted from the recloser-mechanism frame. Figure 18 shows head casting and associated components removed from the mechanism frame.
7. To reassemble, carefully lower head casting in place with the six tubular spacers placed on the lugs. Start the six ton. bolts and tighten evenly to avoid any binding of the mechanism.
8. Engage the contact indicator and lockout lever. Reconnect the operating lever of the auxiliary switch if used.
9. Attach 0.2-MFD capacitor to the recloser frame. Reconnect bushing leads. Be sure bushing leads are positioned as described in the cautionary notes on Page 11.
10. Connect wiring from bushing CT's and cable receptacle to respective terminals on the terminal block. Attach nylon lead-strap to recloser frame.

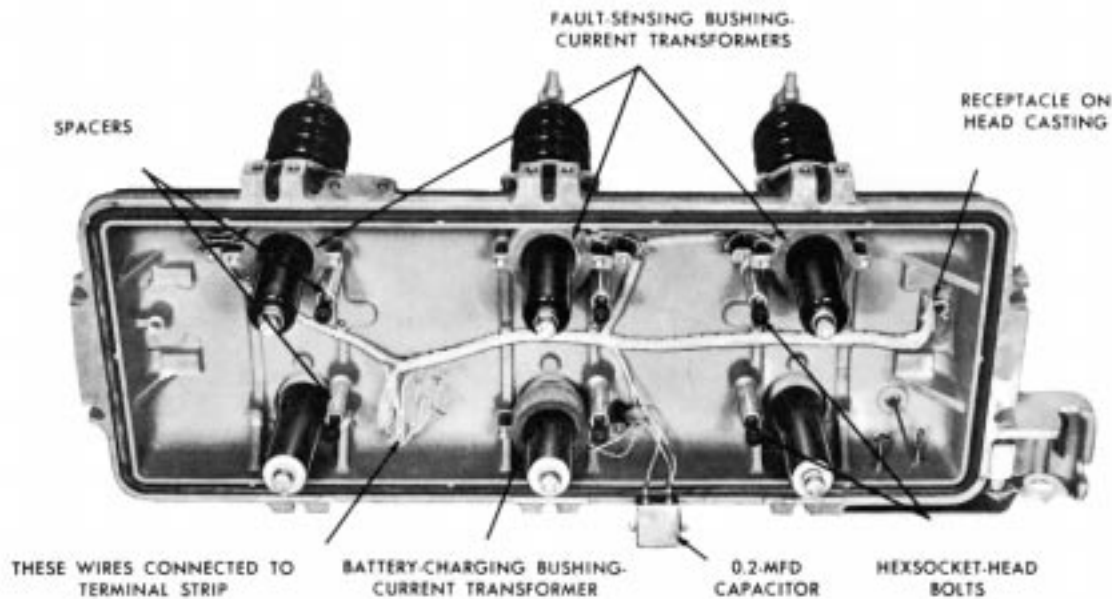


Figure 18

Head casting detached from operating mechanism. Hexsocket-head bolts have been attached to head casting for illustrative purposes

MECHANISM OPERATION

The head mechanism performs the actual opening and closing operations in response to signals from the electronic control. Contact opening is initiated by a trip coil. Contact closing is performed by the closing coil, mounted below the mechanism. The basic lever arrangement in the mechanism is shown here.

With the contacts closed, figure 19, the opening springs are fully extended. The trip coil push rod rests up against the toggle latch and when the trip coil is energized, the toggle opens, figure 20. The contact-and-toggle-support assembly and the contact-and-trip-arm assembly rotate on their shafts and begin to push the contacts open. As the opening springs rotate the contact-and-trip-arm assembly past this point, figure 21, the trip arm moves the reset trip lever, which releases the reset lever. The reset lever is rotated by a spring and snaps the toggle closed.

This motion of the reset lever also pulls the plunger out of the closing coil. At this point the contacts are completely open.

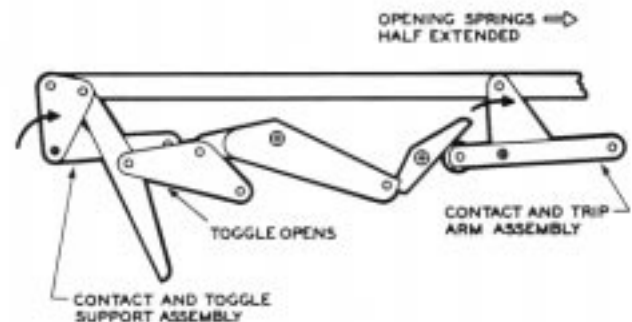


Figure 20
Contacts open halfway.

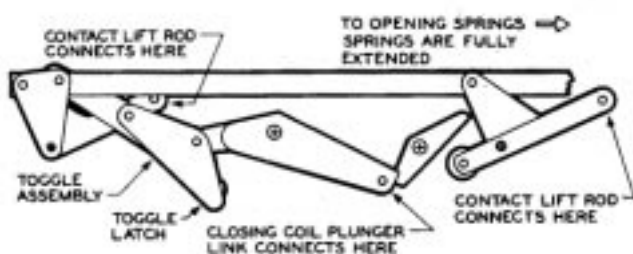


Figure 19
Contacts closed.

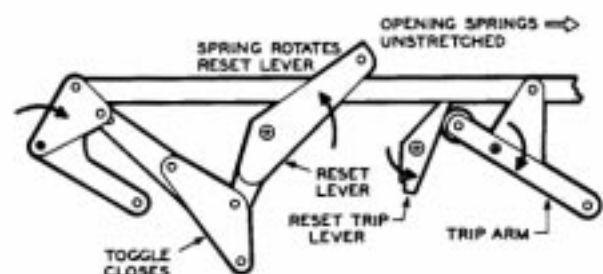


Figure 21
Contacts fully open.

ADJUSTMENTS - CONT'D

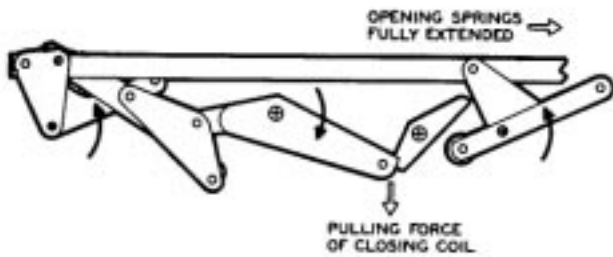


Figure 22
Contacts reclosed.

The closing coil is energized by a signal to the rotary solenoid on the side of the mechanism. The solenoid closes the closing solenoid contactor, which energizes the coil. The plunger is drawn into the coil and the reset lever is pulled back, figure 22, to its original position, at the same time closing the contacts. The mechanism is then ready for another cycle.

RATING CHANGES

The recloser's continuous current rating and minimum trip values can be changed in the field as described in the control installation manual. Closing solenoid coils are available for eight voltage ranges from 2.4 to 14.4 kv. Note that the voltage rating represents phase-to-grounded neutral voltage.

Two d-c coils rated at 125- and 250-volts dc also are available. When the closing solenoid coil is changed, as described on page 9, the protective fuse may also require replacement. One fuse is shipped with each replacement coil. Fuse and coil data are given on pages 10 and 11.

ADJUSTMENTS

Refer to the control installation manual bulletin 281-27SA-1 for information about operations to lockout, reclosing time, phase-trip sequence, minimum-trip values, resetting time, ground-trip sequence, phase-trip timing and ground-trip timing.

CONTROL LEVER OVERTRAVEL ADJUSTMENT

Check for proper adjustment of the control lever by first removing the sleet hood cover to expose the control lever. From the OPEN position, slowly push the control lever toward the CLOSED position. As the lever is pushed up, latching of the recloser will be felt. At this point dimension a of figure 23 should be 1/4 inch.

If the control lever is not adjusted properly, open the C ring and remove it with diagonal cutters. Then slide the control lever from the shaft. Rotate the control lever clockwise to reduce dimension a or counterclockwise to increase dimension a. Reassemble by reversing the procedure when the correct clearance has been set.

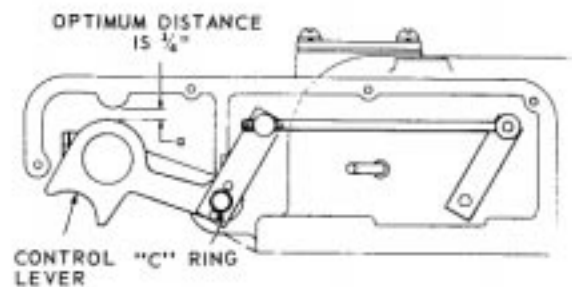


Figure 23
Overtravel adjustment of control lever.

OPERATIONAL CHECKS

Circuit components attached to the recloser cover, frame end operating mechanism require no maintenance and should provide trouble-free operation. However, if the recloser fails to operate properly, perform these steps:

1. Check out the control cable for continuity between pins,
2. Test the circuit components associated with the recloser mechanism as described below, and
3. Check the electronic control as described in the electronic control service manual, bulletin 281 - 27SB -1.

The recloser should be checked out in this order. An ohmmeter-voltmeter such as the Triplet Model M30, which provided reference values for the following tests, is the only equipment necessary for steps 1 and 2.

OPERATIONAL CHECKS - CONT'D

CONTROL CABLE

Remove the recloser from service as described on page 4 if not already disconnected. Then detach the control cable from the receptacles on the recloser cover and underside of the electronic control housing. With the ohmmeter, check for continuity between cable pins and pin sockets. Pins and pin sockets are identified on each cable end.

A zero reading indicates continuity; an infinite reading indicates an open circuit. If an open circuit is discovered, the cable can be reinstalled after the open-circuited lead is repaired or replaced. Continuity between unlike pins or sockets indicates a short circuit. Pins and sockets of the control cable designated N and P are not used.

CIRCUIT COMPONENTS

Refer to figures 17, 24, 25, 26, 27, and 30 for identification of microswitch 1, mercury switches 2 and 3, rotary solenoid, trip solenoid, bushing current transformers, terminal strip, and the configuration of pinsockets of the control-cable receptacle on the head casting. The components are checked out under the three following conditions:

1. Recloser *contacts* open and manual *control* lever down

a. All measurements are made from the pin-sockets of the control-cable receptacle.

b. Connect ohmmeter probes to sockets A and B. The ohmmeter should read approximately 9.5 ohms. If not, difficulty may be present in the trip solenoid.

NOTE: Readings within ± 15 percent of suggested readings are sufficient to indicate components are trouble free.

c. Transfer ohmmeter probes to sockets E and F. Reading of 19 ohms indicates rotary solenoid should be trouble free.

d. Insert ohmmeter common probe into socket K. Insert the positive probe into sockets G, H, then J. All three readings should be 7 ohms. If not, corresponding sensing current transformer may be faulty. Check bushing CT's for ratio and polarity as described in the test procedure on page 17.

e. With ohmmeter common probe still inserted in socket K, insert positive probe into socket L. Ohmmeter should read 1000 ohms. If a reading of zero ohms is obtained, the 0.2-MFD capacitor may be short circuited. Readings deviating from 1000 ohms outside a 20 percent tolerance indicate damaged resistor or transformer winding.

f. Transfer ohmmeter probes to sockets C and D. Infinite ohms should be read indicating microswitch 1 is open-circuited. If not, the mercury switch is faulty, but should be rechecked before replacing.

NOTE: Mercury switch and microswitch positions for combinations of control-lever and recloser-contact positions are tabulated on page 17.

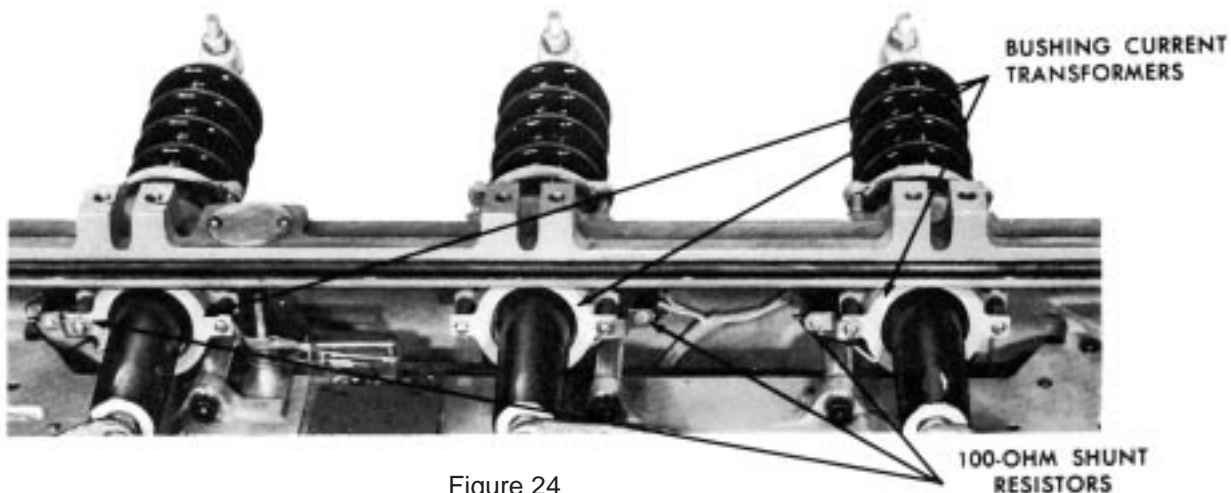


Figure 24

View of fault-sensing bushing current transformers located on source side of recloser. Battery-charging current transformer is located on center-phase loads side bushing .



g. Transfer ohmmeter probes to sockets F and A. The ohmmeter should read infinite ohms. If not, mercury switch 2 may be faulty. Individual checks on mercury switches 2 and 3 can be made by means of pin-sockets N, F, and A.

c. Remove ohmmeter probes from terminals F and A.
A. Connect positive lead of the battery (or 25-volt station d-c source) to socket F. Momentarily connect the negative lead to socket E. Rotary solenoid should operate producing an easily distinguished sound. Repeat two or three times. Connect ohmmeter across source-side B and C phases; see figure 25 for identification of phases. The ohmmeter should show closing coil continuity (effective d-c resistance of coil when rotary solenoid is energized.) Disconnect d-c source.

CAUTION: If the control battery is used as the 25-volt d-c test source, the battery should be connected only as long as is necessary for testing purposes. Lengthy connection across the rotary solenoid will create an excessive drain of energy from the battery, although it has no effect on the solenoid itself. If a station d-c source is used, it can remain connected to sockets E and F from step 2c through completion of testing.

- b. Transfer ohmmeter probes to terminals C and D. Zero ohms indicates that microswitch 1 is operative and closed. Remove KA9OR closing tool and ohmmeter leads from receptacle sockets.

c. Trip recloser by applying 25 volts dc across socket A (positive) and socket B (negative). If recloser contacts do not trip open, trip solenoid may be inoperative.

CAUTION: Recloser should be tripped in oil to avoid damage to the dashpot in the arc-interrupting mechanisms.

Assemble the test circuit as shown in the top drawing of figure 26. Connect the phases in series and close the recloser contacts with KA90R closing tool as described on page 6. Connect a 100-ampere a-c test current supply to points 1 and 2.

CAUTION: Never use the KA90R manual closing tool on an energized recloser.

Ratio Test for Sensing Current Transformers

- 1. Energize 100-ampere test source.
- 2. Check current through control-cable receptacle sockets K-G, K-H, and K-J as identified in figure 25. For each sensing bushing CT checked, the milliammeter should indicate 100 milliamperes, \pm 10 percent. BE SURE TO ALLOW FOR TOLERANCES OF METERING EQUIPMENT. The resistance of certain types of meters is not negligible. It may be necessary to use the 0-500 milliamperere scale, with its lower resistance, rather than the 0-100 milliamperere scale.
- 3. A 100-ma reading verifies the 1000:1 ratio of the current transformer. If 100-ma is not achieved, bushing CT can be suspected as faulty; but polarity test should be performed. De-energize test source.

Polarity Test for Sensing Current Transformers

- 1. Connect sockets G, H, and J of the control-cable receptacle in series with jumper leads as indicated in figure 26. The jumper leads connect the secondaries of the current transformers in parallel so that total output current, measured at points K and J, should be 300 ma.
- 2. Energize a-c test current. Check for 300-ma reading at sockets K and J. Results can indicate either (a) all three bushing current transformers have the same polarity — 300-ma reading, or (b) one bushing current transformer has polarity opposite remaining two—100-ma reading. Should one transformer possess opposite polarity, be sure to refer to the circuit of figure 25 as a guide during further trouble shooting.
- 3. De-energize a-c test current and remove jumper wires from receptacle sockets.

Output Test for Battery-charging Current Transformer

- 1. Energize 100-ampere a-c test current.
- 2. Measure current at sockets K and L of receptacle. Value should fall between 40 and 60 milliamperes.
- 3. Readings within this range indicate sufficient current to maintain the control battery at the optimum voltage level.

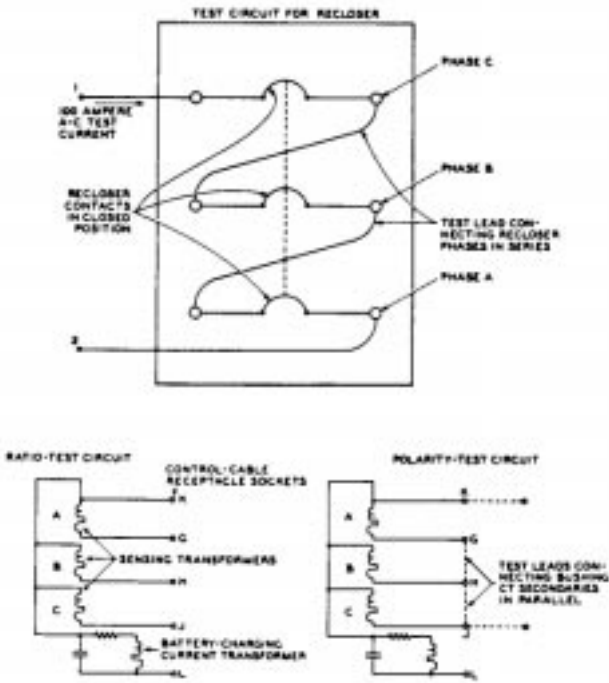


Figure 26

Test circuit for checking bushing current transformers. Ratio and polarity test-circuits shown are the effective circuits that contribute to the testing. Components not having an effect on the current flow are not shown. Dotted lines in the polarity-test circuit are test leads.

TABLE 2

Recloser Contacts	Manual Control Lever	Micro-switch 1	Mercury Switch 2	Mercury Switch 3
OPEN	DOWN	OPEN	OPEN	CLOSED
OPEN	UP	OPEN	CLOSED	CLOSED
CLOSED	UP	CLOSED	CLOSED	OPEN

BUSHING CURRENT TRANSFORMER TESTS

The sensing transformers and battery-charging transformer can be tested using the circuits shown in figure 26. An a-c ammeter possessing a 0 to 500 milliamperere range is required.

OPERATIONAL CHECKS - CONT'D

REPLACEMENT INSTRUCTIONS FOR CIRCUIT COMPONENTS

All circuit components associated with the recloser frame, head casting and operating mechanism except the trip solenoid, rotary solenoid, microswitch 1 and mercury switch 2 can be replaced without detaching the recloser mechanism from the head casting. Instructions for replacing bushing CT's, mercury switch 3, and the 0.2-MFD capacitor are given first.

A 100-watt soldering iron will meet all requirements for repair work. When resoldering lead connections, use only resin core solder. M-E will assume no responsibility for components having leads connected by means of acid core solder.

0.2-MFD Capacitor

Label lead connections to the capacitor and proceed as follows:

1. Heat solder joints to disconnect leads.
2. Remove two screws that secure capacitor to recloser frame.
3. Replace by reversing above procedure. Be sure to reconnect leads to proper capacitor terminals.

Battery-Charging Current Transformer

Label lead connections to the current transformer and shunting resistor. Then proceed as follows:

1. With diagonal cutters, clip the leads close to the current transformer.
2. Disconnect the flexible bushing lead.
3. Remove the two screws that secure the current transformer to the head casting. Bushing CT is now free to be removed.
4. Replace current transformer by reversing the above procedure. Be sure to use spacers between the transformer mounting supports. Replacement transformers are equipped with six-inch leads which can be trimmed as required. When splicing connections, be sure the proper leads are connected before soldering. Be sure to wrap all splices with electrical tape and observe soldering precautions recommended above.

Sensing Bushing-Current Transformers

Replacement of phase A, phase B, and phase C current transformers is identical. These transformers are installed as described above under battery-charging transformer instructions.

Mercury Switch 3

Refer to figure 17. Disconnect leads from terminals A and G and proceed as follows:

1. Loosen two screws that secure nylon mounting straps to lever pinned to main reclosing shaft.
2. Slip mercury switch from mounting straps when screws are loosened sufficiently.
3. Be sure to replace mercury switch so that lead wires are furthest from the rotary solenoid. If the end without lead wires is not nearest the rotary solenoid, improper operation of the recloser mechanism will result.

Remove Head Casting for Remaining Components

To replace the following components — trip solenoid, microswitch 1, mercury switch 2 and rotary solenoid — the recloser mechanism must be removed from the head casting, as described on page 12.

Mercury Switch 2

Refer to figure 27 and install new switch as follows:

1. Disconnect the leads of the mercury switch from the terminal strip terminals F and G.
2. Remove the four nylon mounting straps that secure the sleeving to the recloser frame.
3. Remove the faulty switch from its mounting straps. With an offset screwdriver, loosen the screws that secure the nylon straps to manual-lockout shaft lever to allow removal of switch 2.

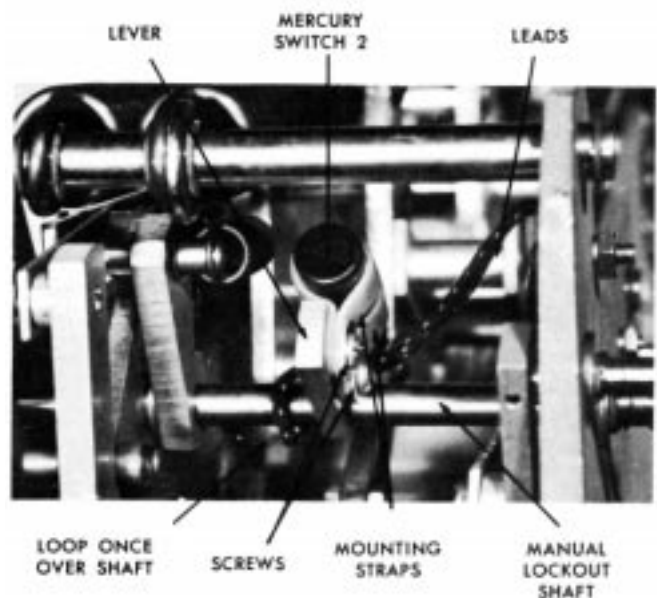


Figure 27
Location of mercury switch 2.

4. Pull the leads through the protective sleeving. Thread the leads of the new mercury switch through the sleeving. Thread both leads at the same time. Leads can be secured to a long wire which can draw the mercury switch leads through the sleeving.

NOTE: Switch leads need only be connected between the proper terminals for correct operation. Reversing leads between switch terminals has no effect on recloser operation.

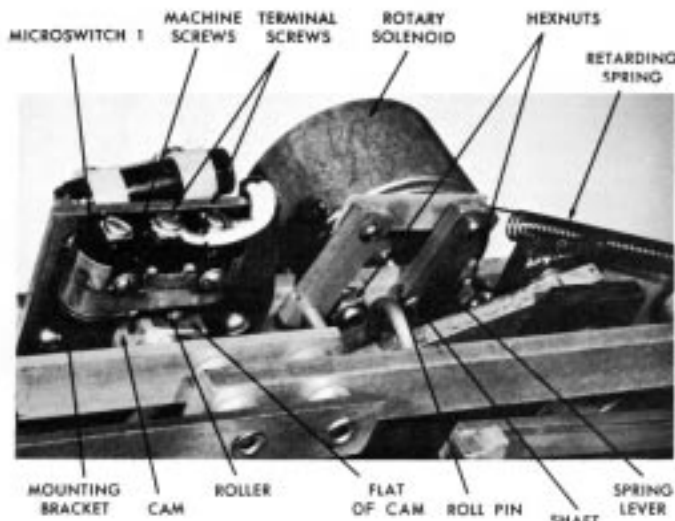


Figure 28
Properly installed microswitch 1.

5. Pass sleeving through mounting straps and tighten to secure sleeving. Connect switch leads to proper terminals. Position switch as shown in figure 27 and secure mounting straps to lever. If switch is positioned opposite to that illustrated in figure 27, the recloser will operate improperly.

Microswitch 1

Refer to figure 28 and proceed as follows:

1. Disconnect the two white leads from the top of the microswitch.
2. Remove two round-head machine screws to release microswitch from mounting bracket. A hexnut and washer will be released from the threaded end of the screw.
3. Attach new microswitch to mounting bracket. Adjust microswitch so that roller lever stop just touches base of switch when roller rides on cam. When roller is off cam, it should just clear flat of cam as shown in figure 28. Tighten machine screws.
4. Reconnect leads to two terminals nearest rotary solenoid as shown.

Rotary Solenoid

Refer to figures 17, 28, and 29 and proceed as follows to replace the rotary solenoid:

1. Drive out the roll pin that secures the spring lever to the rotary-solenoid shaft. Detach retarding spring from cotter pin.

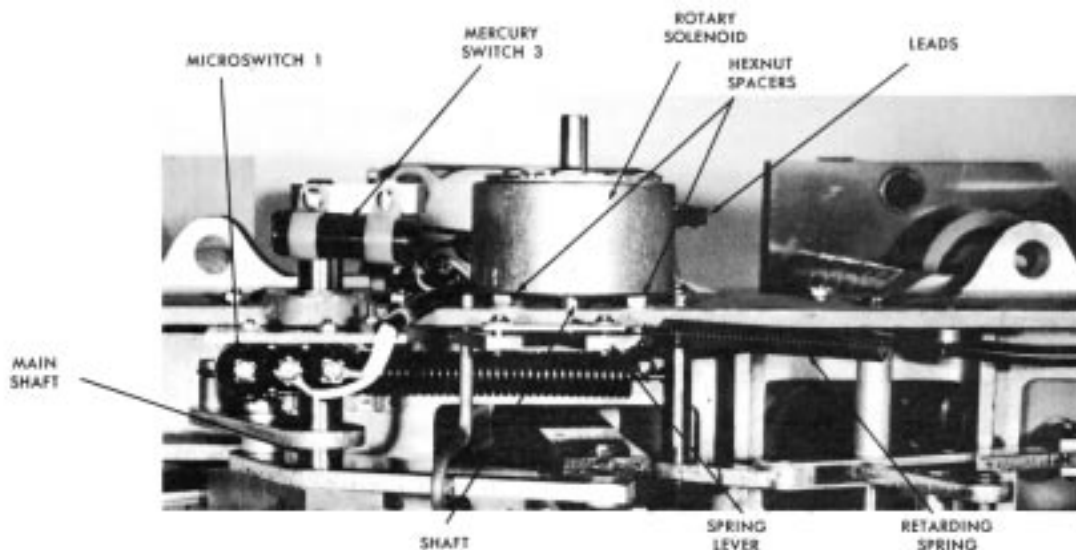


Figure 29
Top view of rotary solenoid and associated components.

OPERATIONAL CHECKS- CONT'D

2. Remove hexnuts and lock washers that secure the rotary solenoid to the recloser frame. Disconnect solenoid leads from the terminal block and remove rotary solenoid.
3. Remove hexnut spacers and washers from rotary solenoid mounting studs and attach to new solenoid. Install new rotary solenoid by reversing the foregoing procedure. Be sure solenoid leads are connected to correct terminals. Refer to figures 17 and 25.

Trip Solenoid

The trip solenoid, figure 30, is replaced as follows:

1. Disconnect leads from terminals A and B of the terminal block.
2. Loosen the hexnut that secures the nylon mounting strap to allow lead sleeving to slip through freely.
3. Remove two socket-head set screws that secure the trip solenoid to the mounting bracket. Detach trip solenoid from bracket. Two lock washers will be released.
4. Install new solenoid by reversing above procedure. Pass leads through nylon mounting strap and grommet in mechanism frame. Connect leads to terminals A and B of the terminal strip in any order. The trip solenoid is not polarity sensitive.

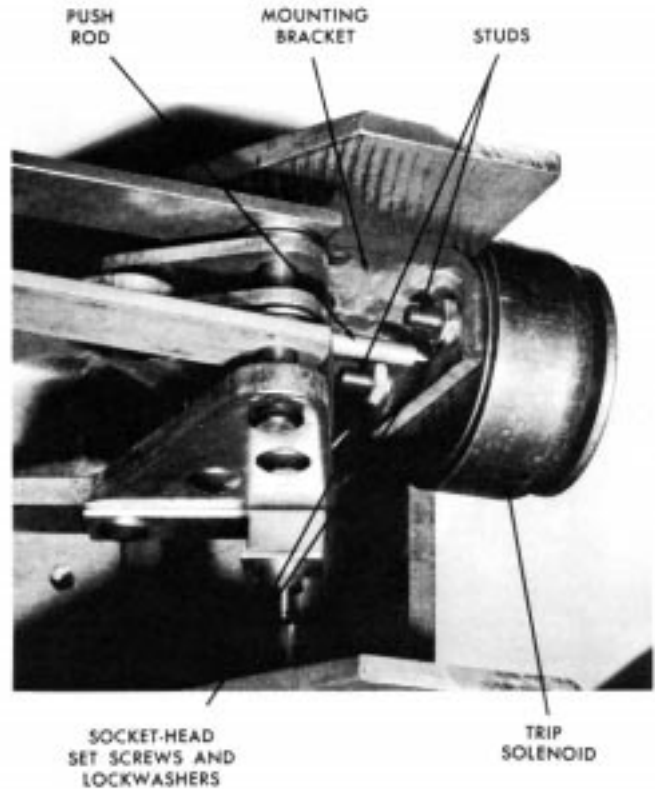
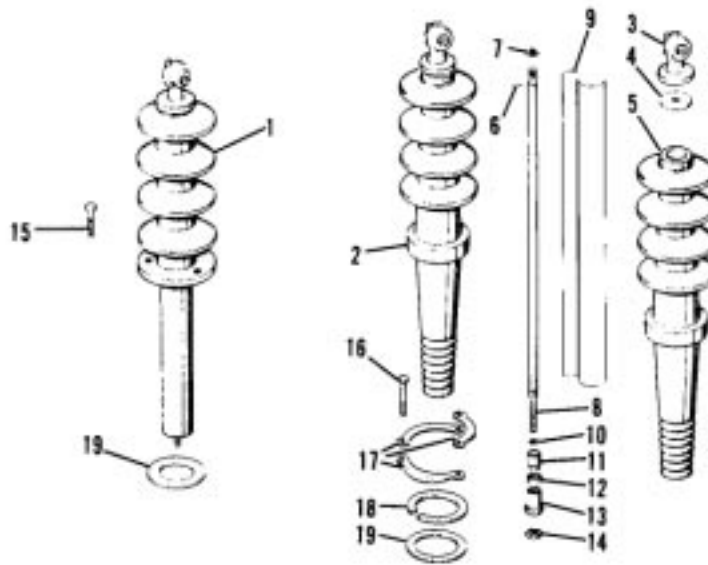


Figure 30
Properly installed trip solenoid

PARTS ORDERING

When ordering replacement parts always include the recloser type and serial number in the ordering information. With Cooper Power System's continuous improvement policy there will be some cases where parts ordered may not be exactly the same as parts furnished. All parts ordered, however, including those of an advanced design, have the same warranty as any whole item of switchgear; i.e., against defects in material or workmanship within a period of One year from date of shipment.

PARTS LIST - TYPE RVE AND WVE RECLOSERS

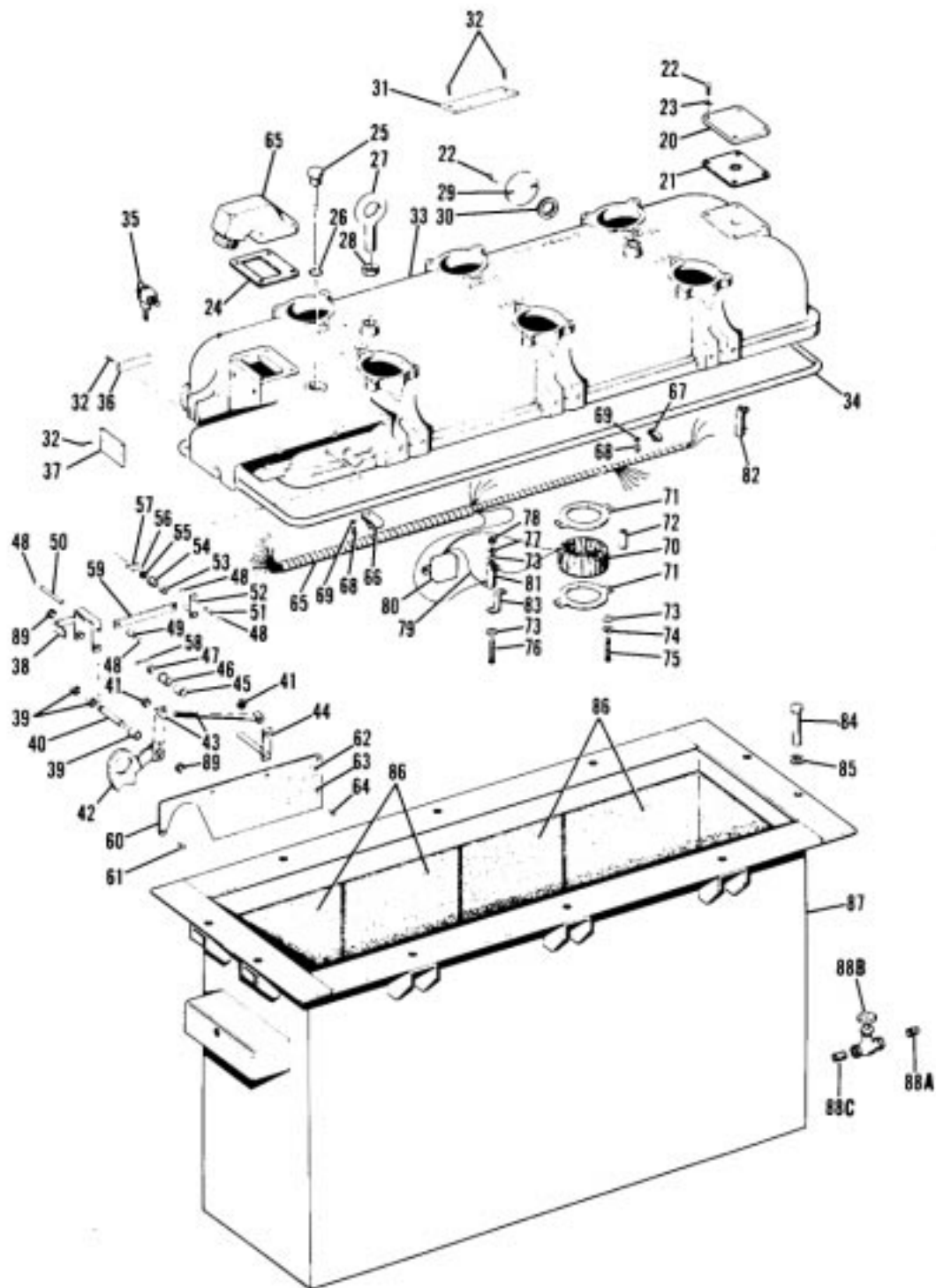


Item No.	Description	Catalog Number	Quantity Per Recloser
1*	Bushing assembly, standard Type WVE Recloser	KA27RV2	6
	Bushing assembly, standard C.T., Type WVE Recloser	KA27RV6	6
	Bushing assembly, 26-1/2" creepage, Type WVE Recloser	KA27RV4	6
	Bushing assembly, 26-1/2" creepage, C.T., Type WVE Recloser	KA27RV8	6
2	Bushing assembly, standard, Type RVE Recloser	KA28RV	6
	Bushing assembly, standard C.T., Type RVE Recloser	KA29RV	6
	Bushing assembly, 26-1/2" creepage, Type RVE Recloser	KA17RV	6
	Bushing assembly, 26-1/2" creepage, C.T., Type RVE Recloser	KA22RV	6
3	Bushing terminal - Type RVE Recloser	KA329R	6
4	Gasket, upper bushing - Type RVE Recloser	KP120L	6
5	Ceramic, bushing, standard Type RVE Recloser	KP541RV	6
	Ceramic, bushing, standard C.T., Type RVE Recloser	KP542RV	6
	Ceramic, bushing, 26-1/2" creepage, Type RVE Recloser	KP534RV	6
	Ceramic, bushing, 26-1/2" creepage, C.T., Type RVE Recloser	KP539RV	6
6	Roll pin, 1/8" x 7/8" lg., Type RVE Recloser	KP517	6

Item No.	Description	Catalog Number	Quantity Per Recloser
7	Washer, Type RVE Recloser	KP1071R	6
8	Terminal rod, standard, Type RVE Recloser	KP511A1	6
	Terminal rod, standard C.T. Type RVE Recloser	KP511A5	6
	Terminal rod, 26-1/2" creepage, Type RVE Recloser	KP511A2	6
	Terminal rod, 26-1/2" creepage, C.T., Type RVE Recloser	KP511A4	6
9	Bushing rod insulation, Type RVE Recloser Secure with gummed tape 0.005" X 3/4" X 9"	KP509RV	6
10	"O" Ring, Type RVE Recloser	KP2000A18	6
11	Sleeve, Type RVE Recloser	KP537RV	6
12	Shock absorber, Type RVE Recloser	KP1257R	6
13	Sealing plug, Type RVE Recloser	KP507RV	6
14	Jam nut, brass, hex 1/2"-20NF2, Type RVE Recloser	KP291	6
15	Mach. bolt, 3/8"-16UNC2 x 1", sstl. hex hd.	KP738	18
16	Mach. bolt 3/8"-16UNC2 x 2" sstl. hex hd.	KP763	18
17	Bushing clamp	KP1109R	18
18	Bushing clamping ring aluminum	KP1111R	6
19	Lower bushing gasket	KP1112R	6

*WVE bushing assemblies cannot be dismantled and must be replaced as complete assemblies.

PARTS LIST - TYPE RVE AND WVE RECLOSER
(Tank and Cover Assemblies)

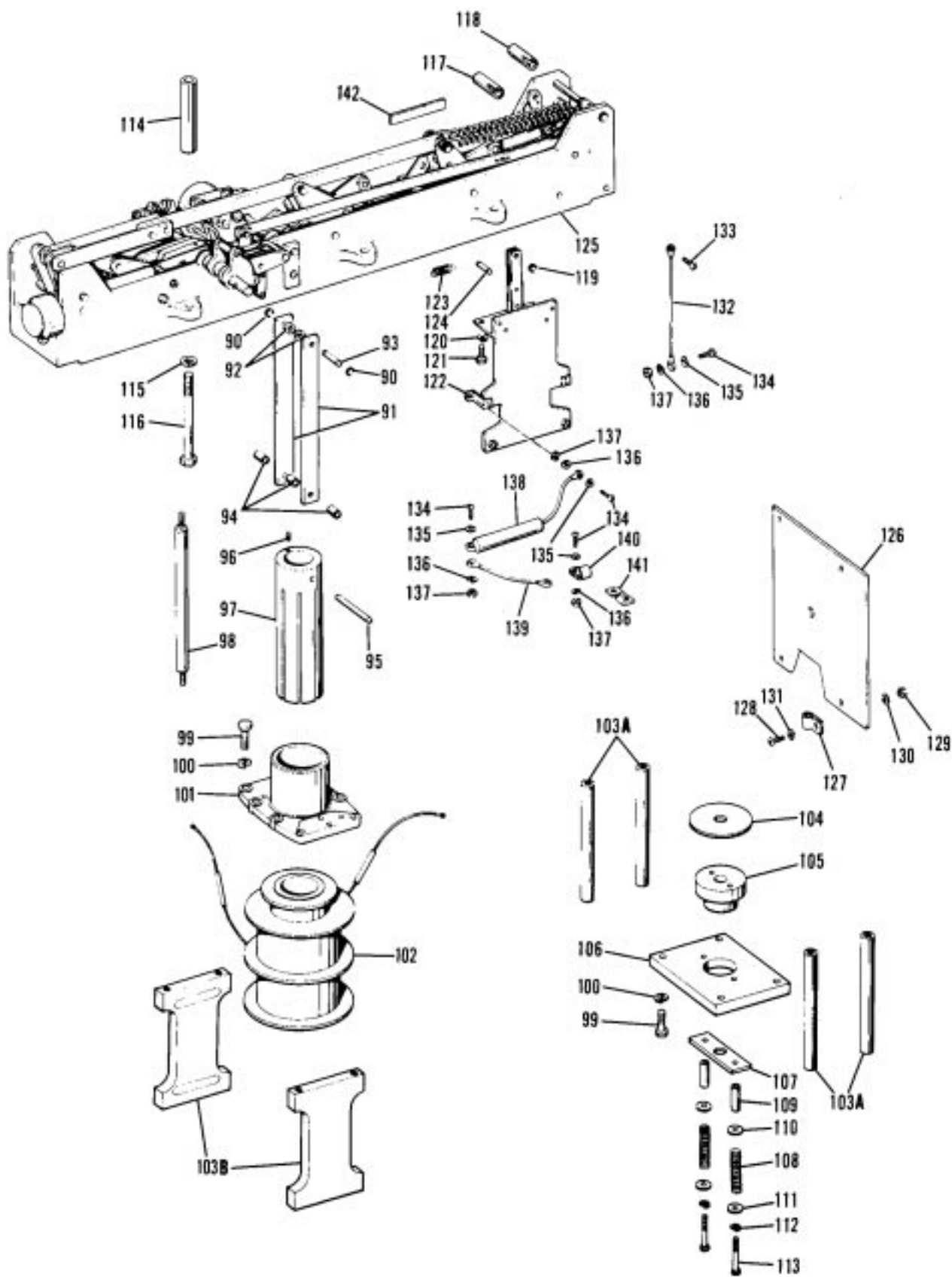


PARTS LIST - TYPE RVE AND WVE RECLOSERS

Item No.	Description	Catalog Number	Quantity Per Recloser
20	Cover plate	KP609R	1
21	Mounting gasket far auxiliary switch	KP610R	1
22	Mach. screw, 1/4" -20UNC2 x 5/8", sssl. rd. hd.	KP613	10
23	Lock washer, 1/4"-20UNC2	KP563	8
24	Terminal box gasket	KP611R	1
25	Oil level dipstick	KA363R	1
26	O-ring gasket	KP2000A9	1
27	Lifting eyebolt	KP1104R	2
28	Palnut 5/8" -11UNC2, galv.	KP2064A7	2
29	Closing-tool port cover	KP246R	1
30	Port-cover plate gasket	KP247R	1
31	Plate, closing call	KP1225R	1
32	Self tapping screw, #2 x 3/16", sssl.	KP69	8
33	Head casting (includes control shaft bushings, items 46 and 54)	KA1603R1	1
34	Head gasket	KP120R	1
35	Ground connector	KA392R	1
36	Plate, serial number	KP110GS	1
37	Plate, ground instruction	KP611D	1
38	Indicator and support assembly	KA19RE	1
39	Spacer	KP3013A11	3
40	Groove pin	KP3126A4	1
41	Retaining ring, WA514	KP75	1
42	Lockout handle assembly	KA621R	1
43	Link rod and pin assembly	KA314R	1
44	Handle lever assembly	KA320R	1
45	Spacer	KP3010A6	1
46	Handle shaft bearing (included with item 33)	KP259R	1
47	Retaining Ring, WA516	KP76	1
48	Retaining Ring, WA510	KP72	4
49	Spacer	KP3006A9	1
50	Groove pin	KP3123A12	1
51	Groove pin	KP3123A3	1
52	Shaft and lever assembly	KA319R	1
53	Spacer	KP3007A8	1
54	Shaft bearing (included with item 33)	KP1055R	1
55	Washer, 9/16" x 0.260" x 0.040", brass	KP399	1
56	Cottter pin, 3/31" X 1/2", brass	KP302	1
57	Roll pin, 1/32" X 1/2"	KP504	1
58	Roll pin, 1/8" X 3/4"	KP502	1
59	Link	KP137RE	1
60	Sleet hood cover plate	KP283R	1
61	Self-tapping screw No. 12 x 1/2", sssl.	KP50	5
62	Serial number nameplate, RVE	KP1RVE	1
	Serial number nameplate, WVE	KP101WVE	1

Item No.	Description	Catalog Number	Quantity Per Recloser
63	Voltage rating nameplate, a-c coils, add correct number: 3 - 7.2 to 8.32 kv; 4 - 12.0 to 13.8 kv; 5 - 14.4 kv; 7 - 11.0 kv (Item 63 is also included with Item 102)	KP567R_____	1
	Voltage rating nameplate, d-c coils, add de coil rating to serial number (Item 63 is also included with Item 102)	KP1368R_____	1
64	Self-tapping screw, No. 4 x 3/16", sssl.	KP21	8
65	Receptacle wiring duct assembly	KA33RE1	1
66	Cable clamp	KP2006A2	4
67	Cable clamp	KP2006A1	2
68	Machine screw, #8-32UNC x 5/16", lg. rd. hd. stl. cad. pl.	KP678	6
69	Lockwasher, #10 med. sssl.	KP994	6
70	Current transformers	KP144RE	4
71	Support, current transformers	KP145RE	8
72	Spacer	KP3009A38	8
73	Washer, #14S, plain, brass	KP339	16
74	Lockwasher, 18-8, 1/4" x 0.109" x 0.062", sssl.	KP563	8
75	Cap screw, 14".20NC2 x 2-1/4", lg. hex hd. stl. cad. pl.	KP798	8
76	Machine screw, #10-24NC2 x 2-1/2" lg. rd. hd. stl. cad. pl.	KP668	4
77	Lackwasher, #10 med.	KP564	4
78	Mach. screw nut, #10-24NC2 hex cad.	KP272	4
79	Lead wire	KP5339A1050	2
80	Capacitor, #23355, 0.2 MFD Potter Co. 2500 VDCW		1
81	Resistor, 1K, 25W	KP4022A36	1
82	Resistor, 100 ohm, 25W	KP4022A31	3
83	Terminal bracket	KP96GS	4
84	Cap screw, 1/2"-13NC2 x 3-1/4", electro zn and iridite pl. hex hd. stl.	KP752	10
85	Washer, wrought galv.	KP2028A23	10
86	Tank liner kit	KA867R	1
87	Tank assembly	KA88W	1
88A	Pipe plug, 1/2", solid sq. hd. brass	KP2007A3	1
88B	Gate valve, 100 lb.-1/2", brass, optional	KA809R	1
88C	Close nipple (included with item 88B)	KP2039A1	1
89	Retaining ring, WA518, stl.	KP79	4

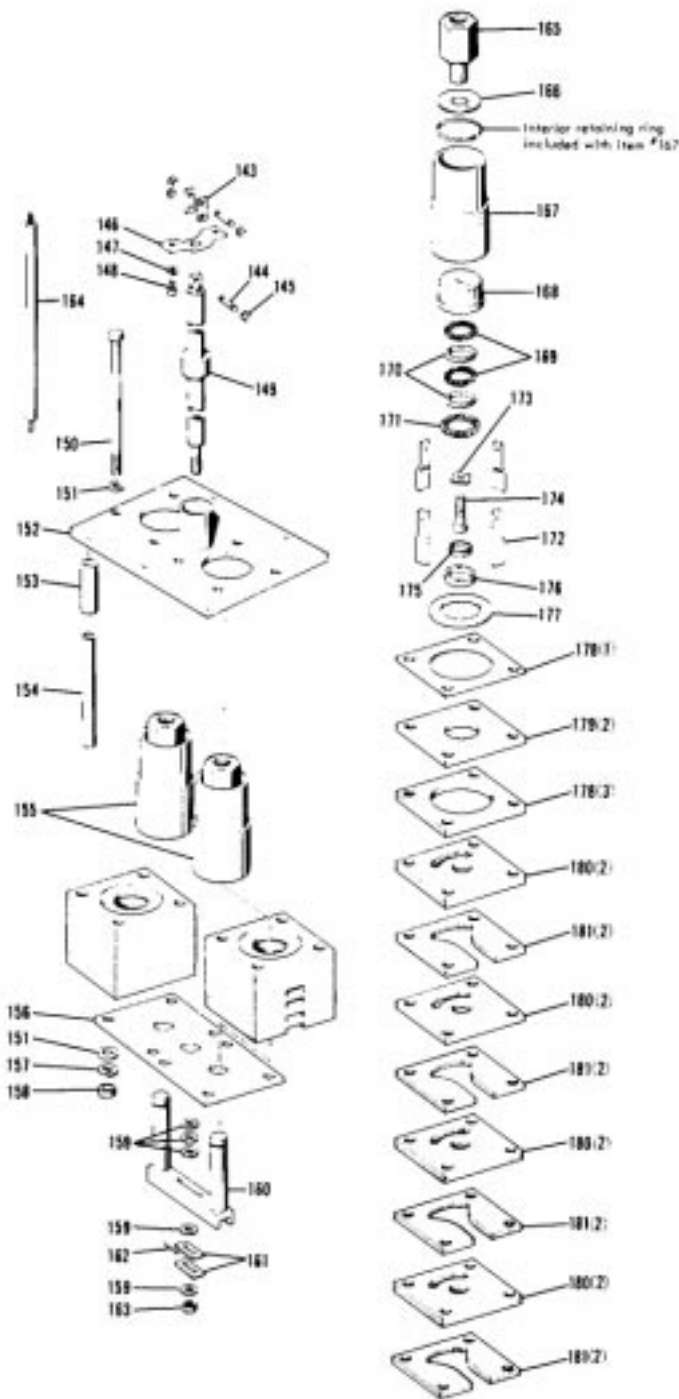
PARTS LIST -TYPE RVE AND WVE RECLOSERS



PARTS LIST -TYPE RVE AND WVE RECLOSERS

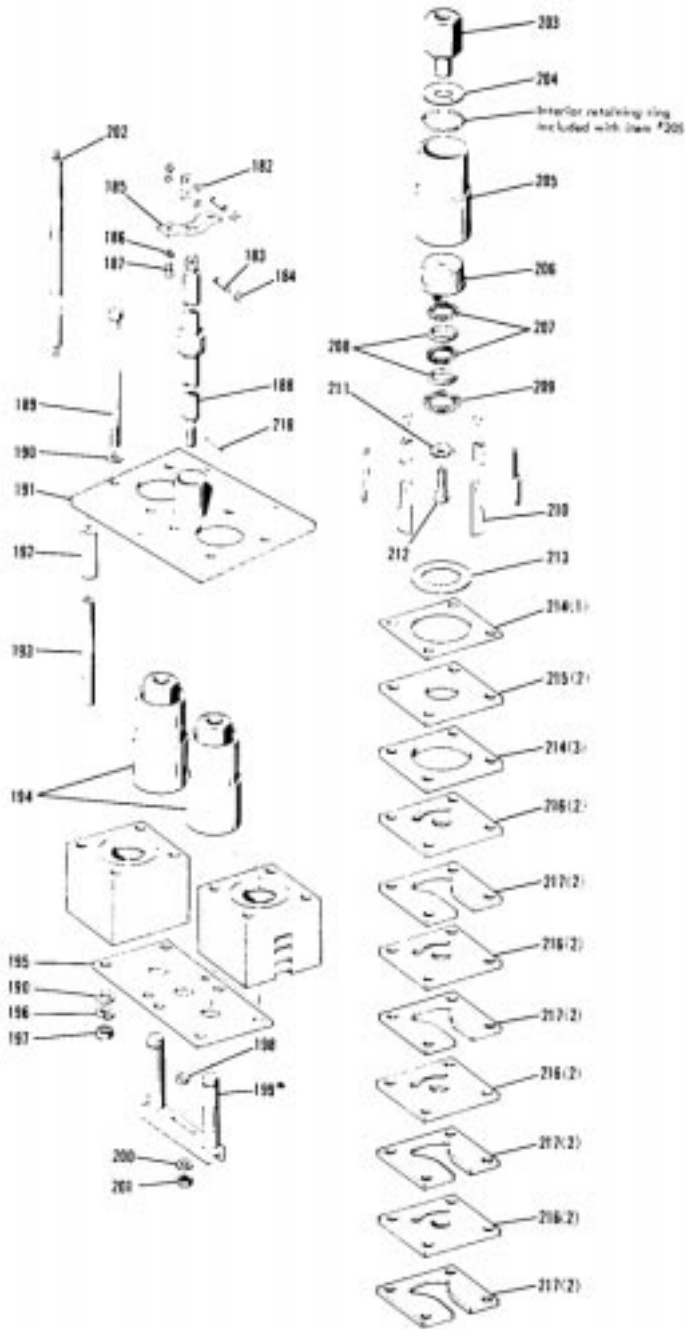
Item No.	Description	Catalog Number	Quantity Per Recloser	Item No.	Description	Catalog Number	Quantity Per Recloser
90	Retaining ring, WA518	KP79	2	116	Socket cap screw, 1/2"-13UNC2 x 4-1/2, stl. hex (black oxide finish or equivalent)	KP2036A3	6
91	Insulating link for closing plunger	KP103R	2	117	Quick-release control lever coupler	KP1177R	1
92	SAE washer 13/16", x 13/32" x 0.062", zinc pl.	KP1102	2	118	Quick-release counter shaft coupler	KP1056R	1
93	Plunger link pin	KP3126A2	1	119	Retaining ring, WA514, stl.	KP75	7
94	Spacer for plunger link	KP3010A1	3	120	Lockwasher 1/4" X 0.109" x 0.062", stl.	KP337	3
95	Plunger link pin	KP113R	1	121	Cap screw, 1/4"-20UNC2 x 3/4", stl. hex hd.	KP735	3
96	Set screw, No. 10-32 x 1/4" pin lock	KP394	1	122	Closing solenoid contactor kit	KA852R	1
97	Closing plunger	KP104R	1	123	Contact toggle spring	KP141R	2
98	Insulating spacer	KA62R	13	124	Contact link pin	KP1306R	1
99	Cap screw, 3/8"-16UNC2 x 1-1/2", stl. hex hd.	KP419	8	125	Mechanism frame assembly (see parts list page 28)	KA68RE	1
100	Lockwasher, 3/8" med. steel	KP556	4	126	Shield	KP531RV	1
101	Upper solenoid frame	KP100R2	1	127	Conduit strap, 3/4", Graybar #1277		
102	Closing coil and fuse kit - 60 cycle, add correct number: 3 - 7.2 to 8.32 kv; 4 - 12.0 to 13.8 kv; 5 - 14.4 kv, 7 - 125 v dc; 8 - 250 v dc; 9 - 11.0 kv. Closing coil and fuse kit - 50 cycle, add correct number: 3 - 7.2 to 8.32 kv; 4 - 12.0 to 13.8 kv; 5 - 14.4 kv; 9 - 11.0 kv Closing coil and fuse kit - 40 cycle, add correct number: 4 - 12.0 to 13.8 kv; 5 - 14.4 kv.	KA834R	1	128	Screw, # 10-24UNC2A x 5/8", lg., rd. hd., stl.	KP1041	4
		KA861R	1	129	Stop nut, elastic	KP2020A13	4
		KA860R	1	130	Washer, #10 SAE, stl.	KP1115	4
103A	Rod, solenoid frame	KP1669R	4	131	Washer	KP753R	4
103B	Solenoid frame shoe (Alternate for 103A)	KP102R	2	132	Wire Assembly	KA28W2	1
104	Fiber stop (also included with item 102)	KP106R	1	133	Screw, self-tapping, #10 x 3/8", sstl.	KP52	1
105	Closing plunger stop	KP1667R	1	134	Machine screw 1/4"-20UNC2 x 1/2" brass, rd. hd.	KP473	4
106	Bridge plate	KP1668R	1	135	Washer, #14L, plain, brass	KP818	4
107	Plate	KP1587R1	1	136	Lockwasher, 1/4" med., phos. buzz	KP347	4
108	Spring valve lift	KP563R	2	137	Machine screw nut 1/4"-20UNC2, brass hex	KP274	4
109	Spacer	KP3009A6	2	138	Closing coil fuse assembly Add number to indicate voltage rating: 3 - 12.0 to 14.4 kv (color band one red) 4 - 2.4 kv (color band two red)	KA259R	1
110	Washer, 1/2" AN light, stl.	KP1103	1	139	Fuse wire jumper assembly	KA28W1	1
111	Washer, #14L, brass	KP818	2	140	Fuse bracket (included with item #138)	KP714R	1
112	Lockwasher, 1/4", med.	KP337	2	141	Fuse terminal bracket	KP257L	1
113	Cap screw 1/4"-20UNC2 x 2-1/4" stl. hex hd.	KP751	2	142	Non-reclosing shaft link	KA25R	1
114	Head-to-frame spacer	KP227R1	6				
115	Lockwasher, 1/2" med. stl. zn pl.	KP1107	6				

**PARTS LIST FOR INTERRUPTING MECHANISM
TYPE RVE RECLOSER ONLY
SEE PAGE 27 FOR WVE PARTS LIST**



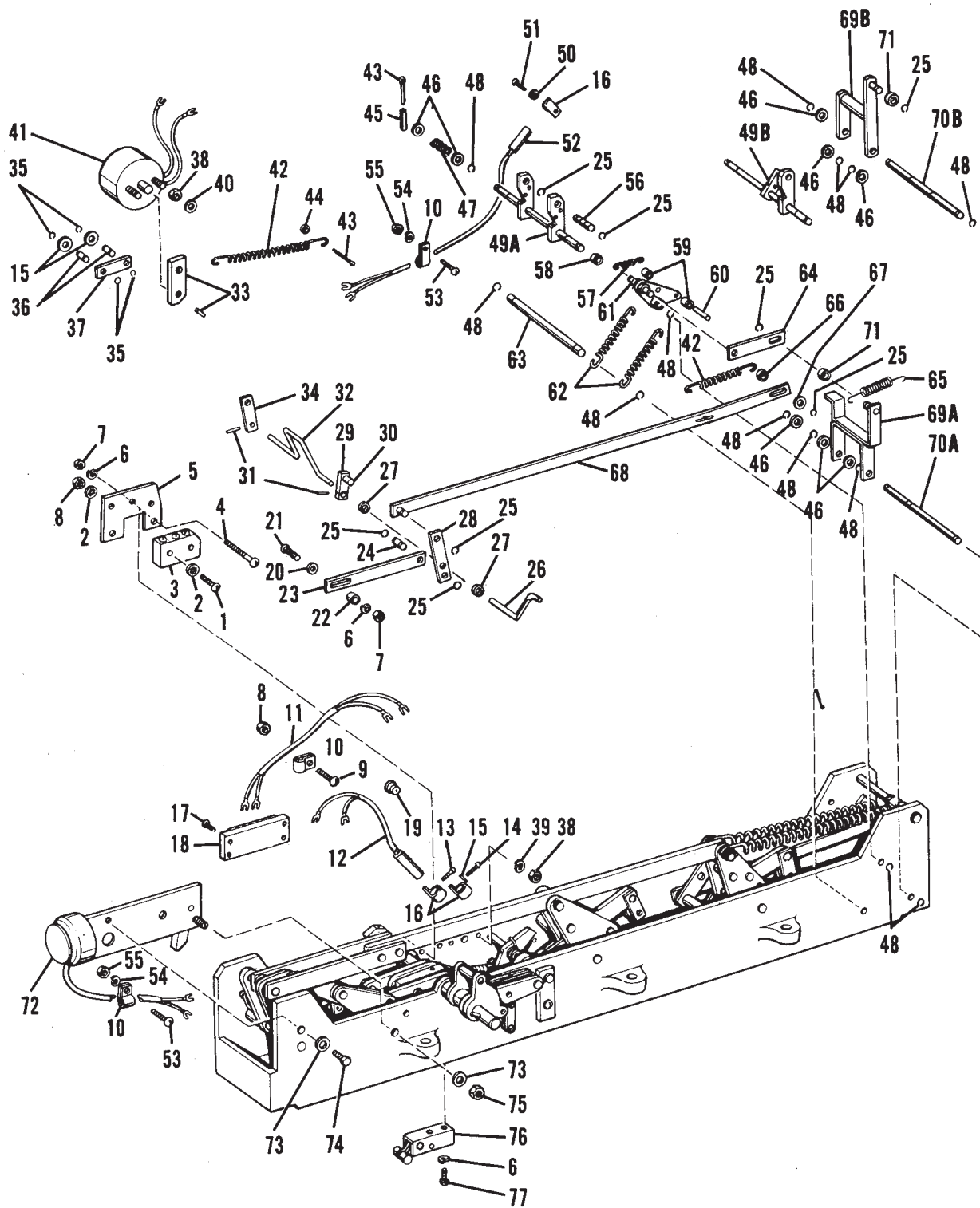
Item No.	Description	Catalog Number	Quantity Per Recloser
143	Lift rod link	KP167R	6
144	Groove pin	KP3125A2	6
145	Retaining ring, WA516	KP76	12
146	Guide, contact rod	KP518RV1	3
147	Lock washer, 1/4" med.	KPI040	6
148	Screw, rd. hd., stl., 1/4"-20UNC2A x 1/2"	KP837	6
149	Contact rod assembly, phases A and B	KA6RV1	2
	Contact rod assembly, phase C	KA6RV2	1
150	Cap screw, stl., 3/8"-16UNC2A x 6-1/2"	KP1Q72	24
151	Washer, 13/32" x 13/16" x 0.062"	KP807	48
152	Contact frame assembly, phases A and B	KA3RV1	2
	Contact frame assembly phase C	KA3RV2	1
153	Spacer	KP3013A40	24
154	Spacer	KP3008A9	24
155	Contact housing assembly	KA11RV	6
156	Bottom plate	KP524RV	3
157	Lockwasher, 3/8", med.	KP1108	24
158	Hex nut, stl., 3/8"-16UNC2B	KP276	24
159	Washer, 5/16" SAE flat, stl.	KP350	15
160	Contact yoke assembly	KA16VLR	3
161	Spacer	KP1505R	6
162	Rail pin, 1/8" X 13/16"	KP506	3
163	Stop nut, elastic	KP2020A2	3
164	Insulating spacer	KA62R	13
165	Contact nut	KP513RV	6
166	Washer, retaining	KP515RV1	6
167	Fiber tube (includes retaining ring)	KP512RV	6
168	Contact cup	KP514RV	6
169	Contact spring	KP1519R	12
170	Spring spacer	KP1513R	12
171	Garter spring	KP1520R	6
172	Contact arm assembly	KA539R	24
173	Contact retainer	KP1514R	6
174	Cap screw, fillister hd.	KP1694R	6
175	Ring	KP3014A4	6
176	Shock absorber	KP1257R	6
177	Gasket	KP136W	6
178	Plate	KP1293M	24
179	Plate	KP213W	12
180	Plate	KP521RV	48
181	Plate	KP523RV	48

**PARTS LIST FOR INTERRUPTING MECHANISM
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SEE PAGE 26 FOR RVE PARTS LIST**



Item No.	Description	Catalog Number	Quantity Per Recloser
182	Lift rod link	KP167R	6
183	Groove pin	KP3125A2	6
184	Retaining ring, WAS16	KP76	12
185	Guide, contact rod	KP518RV1	3
186	Lockwasher, 1/4" med.	KP1040	6
187	Screw, rd-hd, stl., 1/4" 20UNC 2A x 1/2"	KP837	6
188	Contact rod assembly, phases	KA95W2	2
	Contact rod assembly, phase C	KA94W2	1
189	Cap screw, stl., 3/8"-16UNC2A x 6"	KP1068	24
190	Washer, 3/8", SAE, stl.	KP1112	48
191	Contact frame assembly phases A and B	KA127W	2
	Contact frame assembly,	KA128W	1
192	Spacer	KP3013A40	24
193	Spacer	KP3008A23	24
194	Contact housing assembly	KA125W	6
195	Bottom plate	KP214W	3
196	Lockwasher, 3/8", med.	KP1108	24
197	Hex nut, stl, 3/8"-16UNC2B	KP276	24
198	Spacer	KP3011A4	6
199	Contact yoke assembly	KA6WV	3
200	Washer 5/16", SAE, stl.	KP350	3
201	Stop nut, elastic	KP2020A2	3
202	Insulating spacer	KA62R	13
203	Contact nut	KP207W	6
204	Washer, retaining	KP515RV2	6
205	Fiber tube (includes retaining ring)	KP512RV	6
206	Contact cup	KP206W	6
207	Contact spring	KP117W	12
208	Spring spacer	KP210W	12
209	Garter spring	KP209W	6
210	Contact arm assembly	KA124W	36
211	Contact retainer	KP211W	6
212	Cap screw, fil-hd. 3/8"-24UNF 2 x 1-1/4"	KP1069	6
213	Gasket	KP136W	6
214	Plate	KP1293M	24
215	Plate	KP213W	12
216	Plate	KP1294M	48
217	Plate	KP523R4	36
218	Roll pin, 1/8" x 13/16"	KP506	3

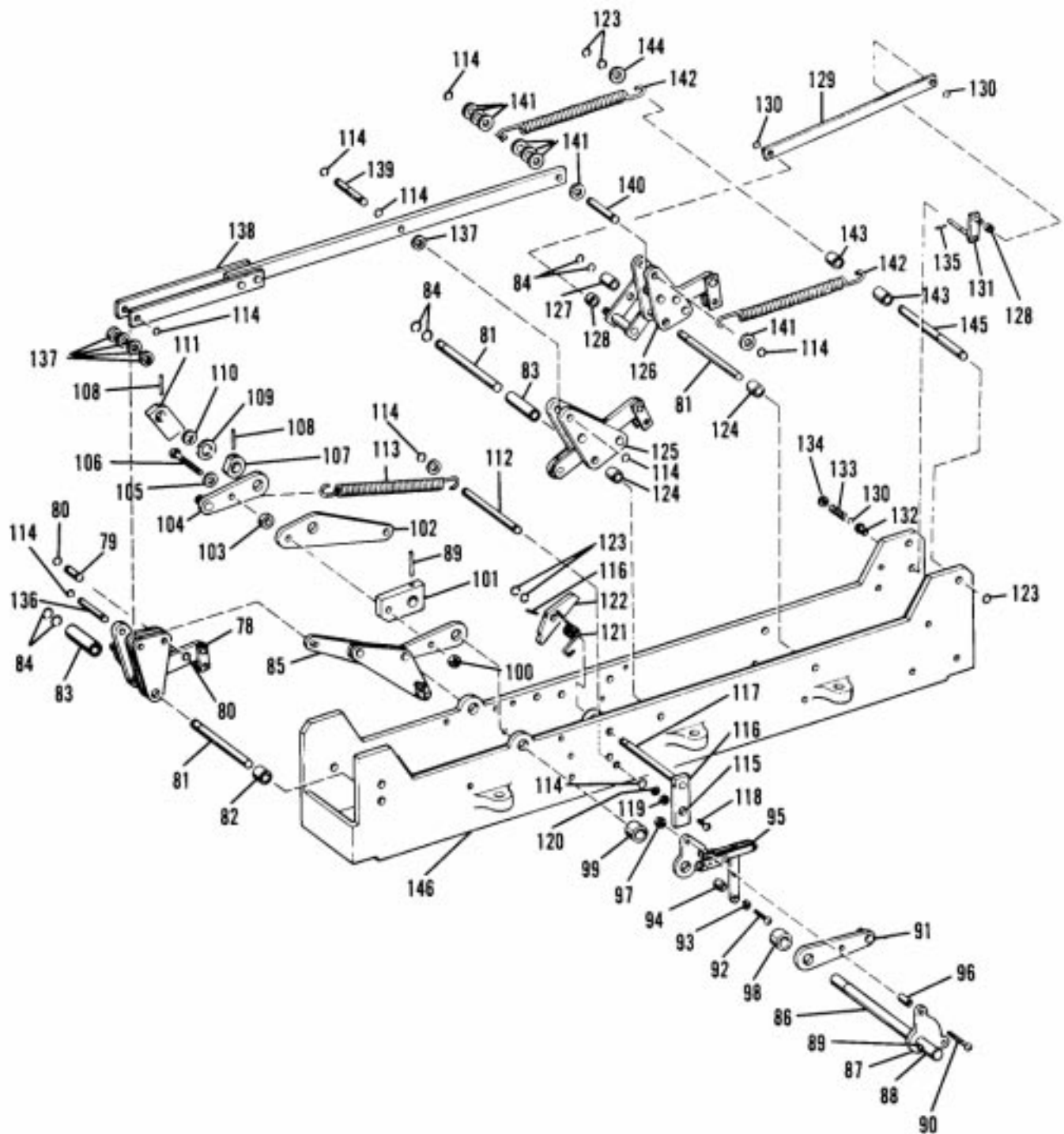
PARTS LIST - HEAD MECHANISM - TYPES RVE AND WVE RECLOSERS



PARTS LIST - HEAD MECHANISM - TYPES RVE AND WVE RECLOSERS

Item No.	Description	Catalog Number	Quantity Per Recloser	Item No.	Description	Catalog Number	Quantity Per Recloser
1	Machine screw, #6-32NC2 x1"			42	Spring, counterbalance	KP98L	2
	lg rd hd brass	KP681	2	43	Cotter pin, 3/32" X 1", lg,brass	KP433	2
2	Lockwasher, #6, internal tooth, bronze	KP826	5	44	Spacer	KP3007A30	1
3	Switch, hermetically sealed type 1HS3 with roller lever actuator (Minneapolis Honeywell)		1	45	Roll pin, 1/8"X 3/4"	KP502	1
4	Machine screw, #10-24NC2 x 3/4", lg rd hd, stl, cad	KP497	2	46	Washer, flat, 5/16", SAE, stl,cad	KP350	13
5	Bracket	KP186RE	1	47	Spring	KP1176R	1
6	Lockwasher, #10 med, stl, cad	KP353	6	48	Retaining ring, WA516	KP77	19
7	Hex nut, #10-24NC2, stl, cad	KP272	4	49A	Handle shaft assembly (used with items 69A and 70A)	KA15RE	1
8	Hex nut, #6-32NC2, brass, cad	KP852	3	49B	Handle shaft assembly (used with items 69B and 70B)	KA15RE	1
9	Machine screw, #6-32NC2 x 1/2" lg rd hd, brass, cad	KP641	1		50 Self-tapping screw, #6-32NC2 x 1/2", lg, Type F	KP30	2
10	Cable clip	KP2006A8	8	51	Washer, #6L, plain, brass		2
11	Lead wire assembly	KA62RE	1	52	Mercury switch subassembly	KA63RE	1
12	Mercury switch	KP134RE	1	53	Machine screw, #8-32NC2 x 5/8", lg, rd hd, brass, cad	KP669	6
13	Machine screw, #8-32NC2 x 1/4", lg rd hd, stl, cad	KP500	1	54	Lockwasher, #8 med, phos. bronze, cad	KP813	6
14	Machine screw, #8-32NC2 x 5/8" lg rd hd, stl, cad	KP669	1	55	Hex nut, #8-32NC2,steel, cad	KP573	6
15	Washer, #10L, plain brass	KP560	4	56	Pin, reset lever	KP280R	1
16	Nylocclip, HP-8N, Burndy	KP2006A4	4	57	Spring	KP16GS	1
17	Machine screw, #6-32NC2 x 5/8", lg fil hd, stl, cad	KP1043	2	58	Spacer	KP330R	1
18	7-terminal board	KP882	1	59	Spacer	KP3006A6	2
19	Grommet, rubber	KP2017A4	1	60	Pin, spring anchor	KP282R	1
20	Washer, #10S, plain, brass, cad	KP840	1	61	Trip lever assembly	KA17RE	1
21	Machine screw, #10-24NC2 x 1/4", lg rd hd, stl, cad	KP670	2	62	Spring, bell crank	KP12GS	2
22	Spacer	KP133RE	1	63	Shaft, spring anchor	KP1488R	1
23	Link	KP128RE	1	64	Link	KP1147R	1
24	Groove pin	KP3124A3	1	65	Spring	KP731R	1
25	Retaining ring, WA514	KP75	10	66	Spacer	KP3007A1	1
26	Arm	KP1295R	1	67	Washer, #14S, plain,brass, cad	KP811	1
27	Spacer	KP3009A9	2	68	Auxiliary switch bar assembly	KA253R	1
28	Lever	KP130RE	1	69A	Trip latch lever (used with items 49A and 70A)	KA647R	1
29	Lever, order with item #30	KP118RE	1	69B	Trip latch lever (alternate used with items 49B and 70B)	KA13RE	1
30	Pin, order with item #29	KP119RE	1	70A	Shaft (used with items 49A and 69A)	KP1678R	1
31	Roll pin, 3/32" X 1/2"	KP504	3	70B	Shaft (alternate-used with items 49B and 69B)	KP125RE	1
32	Transfer shaft	KP152RE	1	71	Spacer	KP3007A8	1
33	Roll pin and lever (included in item 41)			72	Solenoid trip assembly (The solenoid may be ordered separately as part no. KP182RE)	KA55RE	1
34	Lever	KP117RE	1	73	Flat washer, 1/4", SAE, stl cad	KP827	2
35	Retaining ring, #WA510	KP72	4	74	Cap screw, 1/4"-20NC2 x 1/2" lg hex hd stl cad	KP701	1
36	Groove pin	KP3123A4	2	75	Hex nut, 1/4"-20NC2, stl, cad	KP279	1
37	Link	KP126RE	1	76	Cam roller assembly	KA67R	1
38	Hex nut, 1/4"-28NF2, stl, cad	KP290	4	77	Machine screw, #10-24NC2 x 7/16",lg, rd hd,stl cad	KP489	2
39	Lockwasher, 1/4", med	KP337	4				
40	Washer, #14S, plain, brass, cod	KP811	3				
41	Rotary solenoid assembly	KA12RE	1				

PARTS LIST - HEAD MECHANISM - TYPES RVE AND WVE RECLOSERS



PARTS LIST - HEAD MECHANISM - TYPES RVE AND WVE RECLOSERS

Item No.	Description	Catalog Number	Quantity Per Recloser
78	Contact and toggle support assembly	KA361R	1
79	Toggle pin	KP273R	1
80	Retaining ring #5133-37, Type E	KP86	2
81	Shaft	KP1198R	3
82	Spacer	KP3009A18	1
83	Spacer	KP3009A22	2
84	Retaining ring, WA520	KP100	6
85	Toggle assembly	KP450R	1
86	Reclosing shaft (order only with items 87, 88 and 89)	KP295R	1
87	Roll pin, 1/8" X 1-1/4", lg. (order only with items 86, 88, and 89)		
88	Toggle driver (order only with items 86, 87, and 89)	KP1329R	1
89	Roll pin, 3/32" X 1-1/4", lg. (order only with items 86, 87, and 88)	KP512	2
90	Machine screw, #10-32NF2 x 1-1/4", lg. rd. hd., stl., cad.	KP630	1
91	Switch driver	KP148R	1
92	Machine screw, 1/4"-20NC2 x 1-1/4", lg. rd. hd., stl., cad.	KP479	2
93	Lockwasher, 1/4" med.	KP337	4
94	Spacer	KP3007A15	2
95	Switch toggle assembly	KA428R	1
96	Spacer	KP3006A4	1
97	Stop nut, elastic, #10-32NF2	KP2020A1	1
98	Spacer	KP3015A2	1
99	Spacer	KP3015A3	1
100	Stop nut, #10-24NF-3 elastic	KP2020A2	1
101	Reset lever	KP166R	1
102	Reset lever	KP164R	1
103	Spacer	KP3011A4	1
104	Reset arm and pin assembly	KA17R	1
105	Washer 1/4", x 0.375" x 0.031" thk, brass, cad. (optional)		
106	Bolt	KP346R	1
107	Cam	KP187RE	1
108	Rail pin, 1/8" x 1", lg.	KP518	1
109	Washer	KP2028A4	1
110	Retaining ring, #5133-62, Type E	KP87	1
111	Mounting bracket	KP163RE	1

Item No.	Description	Catalog Number	Quantity Per Recloser
112	Shaft, spring anchor	KP292R	1
113	Spring, reclosing	KP191R	1
114	Retaining Ring, WA516	KP77	36
115	Lever reset trip (order only with items 116 and 117)	KP194R	1
116	Roll pin, 3/32" X 3/4", lg. (order only with items 115 and 117)	KP523	2
117	Shaft (order only with items 115 and 116)	KP153RE	1
118	Machine screw, #10-24NC2 x 1", lg. rd. hd., stl., cad.	KP670	1
119	Hex nut, #10-24NC2, stl., cad.	KP272	1
120	Lockwasher, #10 med., st., cad.	KP353	1
121	Spring, reset lever	KP172R	1
122	Lever, reset trip	KP171R	1
123	Retaining ring, WA518, Type C	KP79	5
124	Spacer	KP3009A17	2
125	Contact and trip arm assembly	KA360R	1
126	Contact and counter arm assembly	KA359R	1
127	Spacer	KP3009A16	1
128	Spacer	KP3007A8	3
129	Counter link	KP183R	1
130	Retaining ring, WA514, Type C	KP75	10
131	Contact lever and shaft assembly	KA318R	1
132	Bearing, shaft	KP1055R	1
133	Spring	KP1180R	1
134	Washer #14S, plain, brass, cad.	KP811	4
135	Roll pin, 3/32" x 1/2"	KP504	1
136	Groove pin	KP3125A5	1
137	Washer, flat, 5/16", SAE, brz. irr.	KP1120	13
138	Contact bar assembly	KA13R	1
139	Contact bar pin	KP290R	1
140	Pin	KP3125A9	1
141	Washer, flat, 5/16" AN stl., zn. pl.	KP833	8
142	Contact opening spring	KP173R	2
143	Spacer	KP3011A34	2
144	Washer, flat, 3/8" SAE, Stl., cad.	KP547	1
145	Spring anchor shaft	KP284R	1
146	Frame, operating mechanism	KP189RE	1

